National Flood Insurance Program

Final Nationwide Programmatic Environmental Impact Statement

CHAPTERS 1-6

Action Agency:

Federal Emergency Management Agency

Cooperating Agency:

U.S. Environmental Protection Agency

September 2017

NATIONAL FLOOD
INSURANCE PROGRAM

Page Intentionally Left Blank.

Table of Contents

List of Tables

ABBREVIATIONS AND ACRONYMS

ACRONYM	DEFINITION
1973 Act	Flood Disaster Protection Act of 1973
ASFPM	Association of State Floodplain Managers
B	Billion
BFE	Base Flood Elevation
BW-12	Biggert-Waters Flood Insurance Reform Act of 2012
CACs	Community Assistance Contacts
CAVs	Community Assistance Visits
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
CLOMA	Conditional Letter of Map Amendment
CLOMR	Conditional Letter of Map Revision
CLOMR-F	Conditional Letter of Map Revision Based on Fill
CRS	Community Rating System
DHS	Department of Homeland Security
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIA	Federal Insurance Administration
FIMA	Federal Insurance and Mitigation Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FR	Federal Register
GAO	Government Accountability Office
GSSC	Guidelines and Standards Steering Committee
HFIAA	Homeowner's Flood Insurance Affordability Act of 2014
LiMWA	Limit of Moderate Wave Action
LODR	Letter of Determination Review
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision

LOMR-F	Letter of Map Revision Based On Fill
NEPA	National Environmental Policy Act of 1969
NFIA	National Flood Insurance Act of 1968
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NPEIS	Nationwide Programmatic Environmental Impact Statement
P. Law	Public Law
PEA	Programmatic Environmental Assessment
PEIS	Programmatic Environmental Impact Statement
Risk MAP	Risk Mapping, Assessment, and Planning
RMD	Risk Management Directorate
SFHA	Special Flood Hazard Area
T	Trillion
TMAC	Technical Mapping Advisory Council
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
WYO	Write-Your-Own

1 INTRODUCTION

The Federal Emergency Management Agency (FEMA), under the Department of Homeland Security (DHS), is preparing this Nationwide Programmatic Environmental Impact Statement (NPEIS) to evaluate proposed modifications to the National Flood Insurance Program (NFIP). This NPEIS includes an evaluation of the potential impacts to the natural and human environment associated with the NFIP at a programmatic level, as well as an evaluation of impacts of alternative proposals to modify the NFIP. Additionally, this NPEIS identifies opportunities to eliminate, reduce, or mitigate any potential direct or indirect environmental impacts that may be associated with implementation of the modifications to the NFIP included in the alternatives. FEMA's Federal Insurance and Mitigation Administration (FIMA) is conducting this analysis under the requirements of the National Environmental Policy Act of 1969 (NEPA).

1.1 BACKGROUND

The NFIP is a Federal program established by Congress to provide access to federally backed[1] flood insurance protection for property owners and to reduce future flood losses nationwide through sound, community-enforced building and zoning ordinances. Congress designed the NFIP to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by flood events (FEMA, 2011a).

Flooding continues to be the single greatest source of damage from natural hazards in the United States, causing about 82 deaths and $8 billion (B) in property damage annually (NOAA NWS, 2015). Today, more than 22,000 communities participate in the NFIP, with more than 5.1 million flood insurance policies in effect, providing over $1.2 trillion (T) in insurance coverage (FEMA, 2016a) (FEMA, 2013a). The NFIP serves as the foundation for national efforts to reduce the loss of life and property from flood disaster. In 2011, FEMA Administrator Craig Fugate reported to the Senate Committee on Banking, Housing, and Urban Affairs that implementation of the NFIP minimum floodplain management requirements is estimated to save the nation about $1.7B annually through avoided flood losses (Congressional Research Service, 2013).

1.1.1 Purpose of the NFIP

Following the devastating floods that accompanied Hurricane Betsy in 1965, Congress developed the National Flood Insurance Act of 1968 (NFIA). With the passage of NFIA, Congress created the NFIP to "provid[e] appropriate protection against the perils of flood losses" and to "minimiz[e] exposure of property to flood losses" (42 United States Code [U.S.C.] § 4001(c)).

The primary purpose and objective of the NFIP is to provide flood insurance.

> It is therefore the purpose of this title to (1) authorize a flood insurance program by means of which flood insurance, over a period of time, can be made available on a nationwide basis through the cooperative efforts of the Federal Government and the private insurance

[1] Subsidized by the Federal Government.

> industry, and (2) provide flexibility in the program such that flood insurance may be based on workable methods of pooling risks, minimizing costs, and distributing burdens equitably among those who will be protected by flood insurance and the general public. (42 U.S.C. § 4001(d))

Accordingly, the NFIP is first and foremost a program for the provision of flood insurance.[2]

Congress also provided for the development of a floodplain management program that would encourage participating communities to reduce their flood risk and, therefore, reduce the financial losses of those structures insured by the program and benefit the flood insurance fund.

> The Congress further finds that (1) a program of flood insurance can promote the public interest by providing appropriate protection against the perils of flood losses and encouraging sound land use by minimizing exposure of property to flood losses; and (2) the objectives of a flood insurance program should be integrally related to a unified national program for flood plain management… (42 U.S.C. § 4001(c)).

Therefore, a secondary purpose of the NFIP is to undertake a unified program for floodplain management with the purpose of encouraging sound land use practices related to the minimization of damages caused by flood losses. (42 U.S.C. §§ 4001(c) and (e))

In support of the flood insurance and floodplain management aspects of the program, the NFIP was also established for the purpose of providing flood hazard maps.

> (b) The purpose of this Act, therefore, is to –
>
> . . .
>
> (1) Provide for the expeditious identification of, and the dissemination of information concerning, flood-prone areas. (42 U.S.C. § 4002(b)(2))

Up-to-date flood hazard information and maps are needed to support the purchase and rating of flood insurance, enable community-based floodplain management, and increase the Nation's flood hazard awareness.

These are the central purposes of the NFIP. However, other related purposes of the NFIP include

> (1) encourag[ing] State and local governments to make appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses, (2) guid[ing] the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards… (42 U.S.C. § 4001(e))

[2] It is worthy of note that while a large majority of the NFIA is devoted to a discussion of FEMA's responsibilities related to the provision of flood insurance, only one section concerns the minimum floodplain management criteria.

These ancillary purposes are, however, qualified in very important ways. FEMA is not directed to require State and local governments to constrict the development of land exposed to flood damage, but to "encourage" them to do so. Similarly, the purpose of "guid[ing] development of proposed future construction away from locations that are threatened by flood hazards is constrained by the limits of practicability (i.e., "where practicable")" (42 U.S.C. § 4001(e)(2)).

As such, while the ancillary purpose language of the NFIA certainly indicates an intent by Congress to encourage, through the mechanism of the NFIP, State and local communities to guide the development of new construction away from flood hazard areas, this is not intended as a central purpose of the NFIP. Moreover, the broad, highly qualified purpose language in 42 U.S.C. § 4001(e) cannot be read as providing any general or specific authority to the NFIP to restrict floodplain development, but only for the NFIP to encourage States and local communities to do so.

1.1.2 Legislative History of the NFIP

As noted in Section 1.1.1, Congress created the NFIP to "provid[e] appropriate protection against the perils of flood losses" and to "minimiz[e] exposure of property to flood losses" (42 U.S.C. § 4001(c)). The Federal Insurance Administration (FIA) within the Department of Housing and Urban Development administered the NFIP.

For residents of a community (city, town, county, etc.) to purchase flood insurance, their community must formally apply for participation in the NFIP. As part of the application process, the community must adopt various ordinances to regulate new development in identified flood hazard areas. By 1973, around 2,200 communities participated in the program and committed to certain construction restrictions in flood-prone areas (Wright, 2007). However, this represented only 12 percent to 15 percent of the nation's flood-prone localities (Wright, 2007). When Tropical Storm Agnes resulted in substantial damages in 1972, there were only 95,000 policies in force. It became evident that relatively few individuals in eligible communities who had sustained flood damage had purchased flood insurance.

To increase the number of Federal flood policies, Congress passed the Flood Disaster Protection Act of 1973 (1973 Act) (42 U.S.C. §§ 4001–4128). The 1973 Act contained a provision requiring the purchase of flood insurance as a condition of receiving federally backed loans and Federal assistance in special flood hazard areas (SFHA) of participating communities. This is referred to as the mandatory flood insurance purchase requirement. The mandatory flood insurance purchase requirement resulted in an increase in flood insurance policies to approximately 1.2 million policies by the end of 1977, and 5.5 million policies as of May 31, 2012.

The NFIA, as amended by the 1973 Act, states that regulated lending institutions cannot make, increase, extend, or renew any loan secured by improved real estate or a mobile home located, or to be located, in an SFHA in a participating NFIP community unless the secured building and any personal property securing the loan are covered by flood insurance for the term of the loan. See Flood Disaster Protection Act of 1973 (Public Law [P. Law] 93-234, as codified at 42 U.S.C. § 4012a(b)). Furthermore, Federal officers or agencies cannot approve any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, and disaster assistance loan or grant for acquisition or construction purposes within an SFHA in a participating community unless the building or mobile home and any personal property to which such financial assistance relates is covered during the life of the property. Id. at § 4012a(a). For example, this would prohibit mortgage loans guaranteed by the Department of Veterans Affairs, insured by the Federal Housing Administration, or secured by the Rural Economic and Community Development Services. In the case of disaster assistance under the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, as amended, this prohibition only applies to assistance in connection with the flooding.[3]

Following the multi-billion dollar flood disaster in the Midwest in 1993, Congress enacted the National Flood Insurance Reform Act of 1994 (NFIRA) (P. Law 103-325). One of the purposes of the NFIRA was to improve compliance with the mandatory purchase requirements of the NFIP by lenders, servicers, and secondary-market purchasers. Congress was concerned over the low level of insurance participation among eligible property owners and resulting increases in Federal disaster relief payments.

NFIRA requires Federal agency lender regulators to develop regulations to direct their federally regulated lenders not to make, increase, extend, or renew any loan on applicable property unless flood insurance is purchased and maintained. The law also addresses the responsibility of regulated lending institutions and Government-Sponsored Enterprises (e.g., Fannie Mae and Freddie Mac) in providing a notice of and requiring flood insurance coverage for the term of the loan on buildings located in any SFHA in participating NFIP communities.

NFIRA strengthened the 1973 Act by imposing important new obligations on both mortgage originators and servicers, including mandatory escrow requirements for flood insurance and mandatory provisions for "forced placement" of insurance. Specifically, NFIRA requires the forced placement of flood insurance if a lender or servicer determines that the building securing the loan is not adequately insured.

Lenders may require the purchase of flood insurance even if a structure is located outside the SFHA. A decision to require coverage under such circumstance is not legislatively required, but lenders may choose this option to protect their investments.

The NFIP was recently modified in July 2012, when Congress passed the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12) (P. Law 112-141). BW-12 requires FEMA and other agencies to make a number of changes to the administration of the NFIP. Key provisions of BW-12 required the program to phase out subsidies on certain properties built before the community's first Flood Insurance Rate Map (FIRM), known as "pre-FIRM properties." The pre-FIRM properties for which subsidies will be phased out include non-primary residences, business properties, severe repetitive loss properties (1-4 family residences), substantially damaged properties, substantially improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property. BW-12 mandates that the

[3] Section 202(b) of the 1973 Act prohibited Federal officers or agencies from approving any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, disaster assistance loan or grant, for acquisition or construction purposes within SFHAs in non-participating communities. However, the Housing and Community Development Act of 1977 amended Section 202(b) of the 1973 Act to permit regulated lending institutions to make conventional loans in an SFHA of a non-participating community. It required lending institutions to notify the purchaser or lessee of improved property situated in an SFHA of a non-participating community and used to secure a loan being made, increased, extended, or renewed, whether Federal disaster assistance for flood damage will be available.

premium rates on these properties be increased by 25 percent each year until full risk rates are achieved. FEMA has already begun phasing in full risk rates for these properties.

BW-12 also created a Reserve Fund, which is an account that would be established separate from other program funds to be "available for meeting the expected future obligations of the flood insurance program...". FEMA funds this account through a Reserve Fund Assessment added to the premium on NFIP policies. The Reserve Fund Assessment is primarily designed to build reserves to help meet expected future obligations in higher than average loss years; however, the funds can also be used to pay interest or principal on the current large amount of Program borrowing. Introduced in October 2013 as a 5 percent assessment, the Reserve Fund Assessment is currently a 15 percent assessment. These assessments will continue until the annual collections from the Reserve Fund Assessment reach the statutory minimum amount, which at the time the Reserve Find Assessment was introduced was about $1B annually.

BW-12 further clarified FEMA's mapping mandate. FEMA is required to identify, review, update, maintain, and publish NFIP rate maps with respect to all populated areas and areas of possible population growth within the 100-year and 500-year floodplains; areas of residual risk, including areas that are protected by levees, dams, and other flood control structures; areas that could be inundated as a result of the failure of a levee, dam, or other flood control structure; and the level of protection provided by flood control structures (42 U.S.C. § 4101b).

The Technical Mapping Advisory Council (TMAC) provides advice and recommendations to the Administrator of FEMA to improve the preparation of FIRMs. Among its specified statutory responsibilities, TMAC will examine performance metrics, standards and guidelines, map maintenance, delegation of mapping activities to State and local mapping partners, interagency coordination and leveraging, and other requirements mandated by the authorizing BW-12 legislation. In addition, TMAC provides advice and recommendations to the FEMA Administrator on future risks from climate change,[4] rising sea levels, and FIRM development, as mandated by BW-12.

FEMA received the TMAC's final 2015 Annual and Future Conditions Reports in February 2016 (Appendix K). The Annual Report contains 22 recommendations and the Future Conditions Report contains 7 recommendations and 37 sub-recommendations for FEMA's flood mapping program (Technical Mapping Advisory Council, 2016). As the TMAC is expected to issue reports and recommendations annually, FIMA's Risk Management Directorate (RMD) has established a transparent, repeatable framework for evaluating and responding to the recommendations on an annual basis. The framework features an integrated, collaborative process for conducting detailed assessments of the recommendations to inform prioritization, sequencing, and investment decisions.

On March 21, 2014, President Obama signed into law the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA). HFIAA removed some of the provisions of BW-12, not included in the discussion above, requiring the phase out of subsidies on pre-FIRM properties. Additionally, HFIAA amended the BW-12 provision requiring application of full risk rates to policies renewed after a lapse to exclude

[4] The term "climate change" is used as it applies to the CEQ's *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change* (CEQ, 2016).

policies that lapsed because the policyholder was no longer required to maintain flood insurance. FEMA has already implemented this provision.

HFIAA also required a phase out of subsidies on all pre-FIRM properties at a rate of no less than 5 percent and no more than 15 percent premium increases per year, subject to certain exceptions established by statute (such as the BW-12 provisions) requiring a quicker phase out for certain types of pre-FIRM properties. Accordingly, the subsidies on all pre-FIRM properties will likely be phased out within the next 15 to 20 years. FEMA began implementing this provision in 2013 and 2015 (FEMA, 2013b) (FEMA, 2014).

Under HFIAA, other changes to the NFIP include a new surcharge for all new and renewed policies (a $25 surcharge on all policies for primary residences and a $250 surcharge on all other policies). FEMA began assessing the new surcharge in 2015 on all policies, with all funds collected from the surcharge to be deposited in the Reserve Fund described above. In addition, HFIAA requires FEMA to utilize the results of the BW-12 affordability study (the scope of which was expanded by HFIAA) to establish an affordability framework to address the affordability issues that have arisen since the passage of BW-12 and the associated premium rate increases.

Additionally, HFIAA requires FEMA to set the premium rates for properties newly mapped into the SFHA at the same rate as Preferred Risk Policies, after which full risk rates will be phased in. This was intended to alleviate affordability concerns by allowing for the phase-in of full risk rates for these policyholders.

1.2 PURPOSE OF AND NEED FOR ACTION

The purpose for making program modifications to the NFIP is to (a) implement the legislative requirements of BW-12 and HFIAA; and (b) to demonstrate compliance with the Endangered Species Act (ESA). The need to implement the legislative requirements of BW-12 and HFIAA arises from the recent concerns over the fiscal soundness of the NFIP. Flooding has been, and continues to be, a serious risk in the United States. To address the need, in 1968, Congress established the NFIP as a Federal program. The NFIP enabled property owners in participating communities to purchase flood insurance if the community adopted floodplain management ordinances and minimum standards for new construction. However, owners of existing homes and businesses did not have to rebuild to the higher standards, and many received subsidized rates that did not reflect their true risk.

Over the years, the costs and consequences of flooding have continued to increase. For the NFIP to remain sustainable and to increase its fiscal soundness, its premium structure must reflect the true risks and costs of flooding. This is a primary driver for many of the legislatively required changes that are assessed as part of this analysis.

The need to demonstrate compliance with the ESA stems from the many and varying statements from Federal agencies and the public about FEMA's compliance with the ESA, and the perception about the nature of the NFIP and its effects on ESA-listed species and designated critical habitats. FEMA determined that it is currently in compliance with the ESA, but recognizes the need to make program changes that demonstrate ESA compliance to the public.

1.3 THE NATIONAL FLOOD INSURANCE PROGRAM

1.3.1 Floodplain Management

A community's participation in the NFIP is voluntary and participation is based on an agreement between communities and the Federal government. The power to regulate development in the floodplain, including requiring and approving permits, inspecting property, and citing violations requires land use authority. FEMA has no land use authority. The regulation of land use falls under the State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. The NFIP was designed so that floodplain management would be carried out at the State and local levels, where land use authority resides.

FEMA has no direct involvement in the administration of local floodplain management ordinances. The NFIP operates as a Federal-State-local partnership that depends on State statutes and regulations authorizing local governments to regulate floodplain development under the State's police powers to protect the health, safety, and general welfare of its citizens. For the most part, local governments bear the responsibility for protecting residents from flood hazards, working to reduce flood damage, and preserving floodplain functions and resources.

FEMA's role under the NFIP is limited to enrolling communities in the NFIP, setting the minimum floodplain management criteria, providing programmatic monitoring and oversight, providing technical assistance to ensure that communities are complying with the NFIP program requirements, and enforcing the program requirements when there are issues of programmatic non-compliance by a participating community.

1.3.1.1 Enrolling Communities in the NFIP

The NFIP provides flood insurance coverage only in States and communities that adopt and enforce floodplain management measures that meet the minimum floodplain management criteria established by regulation. Communities must apply to participate, submit compliant floodplain management regulations, and meet other program requirements. FEMA has established processes to enroll communities in the NFIP and to ensure that eligible communities continue to meet program requirements.

States also have a role in the NFIP and many have established floodplain management programs. Each State has designated an NFIP State Coordinating Agency as a point of contact for the NFIP. Generally, the State Coordinating Agency is the State environmental, natural resources agency, or the State emergency management agency.

Many States have adopted floodplain management statutes and regulations, and have established and funded their own floodplain management programs. States must have floodplain management regulations or executive orders in place that meet the minimum requirements of the NFIP for State-owned properties in SFHAs. Where a State requires that communities adopt more restrictive requirements than the NFIP minimum requirements, such as a more restrictive floodway, the State requirements take precedence over the NFIP minimum floodplain management standards as long as the State enforces these higher standards.

1.3.1.2 Minimum Floodplain Management Criteria

To participate in the NFIP, a community must adopt and enforce floodplain management regulations that meet the NFIP floodplain management criteria (44 Code of Federal Regulations [C.F.R.] §§ 59.2(b), 59.22(a)(3), 60.1(d), 60.3(a)-(f)). The intent of these standards is to reduce flood risk and loss of life and property.[5] Additionally, communities are allowed—and encouraged—to adopt floodplain management regulations that are more restrictive than the minimum criteria. Higher standards are designed to reduce flood damage and encourage better long-range management and use of flood-prone areas.

FEMA sets certain nationally applicable minimum floodplain management criteria related to reducing flood hazard risk in floodplain areas for all NFIP participating communities. The communities must incorporate these minimum floodplain management criteria into community ordinances and regulations as a condition of participation in the NFIP. Because FEMA has no land use authority, the floodplain management criteria are essentially performance standards. EMA cannot, either directly through the mechanism of the NFIP or indirectly through the NFIP-participating communities, impose restrictions or prohibitions on the types of floodplain development that are allowed in the floodplain, the amount of development that is allowed in the floodplain, the uses of land that are allowed in the floodplain, or any other general land use restriction that is under State or local land use authority. FEMA can only place certain flood risk reduction-related conditions[6] on how that development should be carried out to reduce future flood losses.

> **Example:** The minimum floodplain management criteria do not require communities to prohibit development in the floodway, but they do require the community to ensure that development is done in such a manner that it does not result in an increase in flood heights (subject to certain limited exceptions discussed later in this PEIS). There are a number of ways to meet this performance standard, including, but not limited to: (a) reducing the size of the proposed development; (b) demolishing existing development; (c) not developing; or (d) providing compensatory storage. Because FEMA has no land use authority, FEMA does not dictate how to meet the performance standard.

FEMA is also not authorized by statute to act as a permitting authority. Therefore, floodplain development is regulated at the community level through the community's floodplain management regulations and floodplain development permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for reviewing the proposed development to ensure compliance with their floodplain management ordinance and that all necessary permits have been received from Federal or State agencies from which

[5] Notably, although some minimum floodplain management criteria do utilize the word "prohibit" (e.g., 44 C.F.R. § 60.3(d)(3)'s requirement to "prohibit all encroachments…"), this word was utilized for the purposes of clarity to the participating communities. A careful reading of the regulations reveals that these criteria are actually performance standards (e.g., "prohibit all encroachments…unless it has been demonstrated… that the proposed encroachment will not result in any increase in flood levels…"). As such, FEMA is not exceeding its legal authority by placing an outright prohibition on development.

[6] Flood risk reduction-related conditions are not a Federal undertaking (see Section 4.2.7.2).

approval is required. FEMA has no knowledge of any community-issued permits in the SFHA until subsequent community monitoring efforts occur.

Communities incorporate the floodplain management criteria into their zoning codes, subdivision ordinances, and building codes, or they adopt special purpose floodplain management ordinances. The floodplain management criteria apply to areas mapped as SFHAs. Participating communities must apply the minimum floodplain management criteria to all new construction in the SFHA, as well as to existing buildings in the SFHA that have been substantially damaged or substantially improved, as determined by the community. If a community determines that the cost of any re-construction, rehabilitation, addition, or other improvements to a building equals or exceeds 50 percent of the market value of the building before the construction began, the building is considered a "substantial improvement." If a community determines that the cost of restoring a building equals or exceeds 50 percent of the market value of the building before the damage occurred, the building is considered "substantially damaged" (44 C.F.R. § 59.1).

The community ordinances must also include effective enforcement provisions (44 C.F.R. § 59.2(b)). A community that fails to adequately enforce its floodplain management ordinance may be put on probation or suspended from the NFIP (44 C.F.R. § 59.24(b)-(c)).

1.3.1.3 Map Adoption Process

FEMA identifies and publishes flood hazards nationwide and periodically updates flood hazard data in support of the NFIP. This flood hazard data is provided to the communities in the form of a FIRM and Flood Insurance Study (FIS) report. The FIRM and FIS report provide States and communities with the information needed for land use planning and to reduce risk to floodplain development. Each time FEMA provides a community with additional flood hazard data, that community must adopt new floodplain management regulations, or amend existing regulations, to incorporate the new data. The community has six months to incorporate the new data or it will be immediately suspended from the NFIP. (44 C.F.R. §§ 59.24(a) and 60.13)

1.3.1.4 Training/General Technical Assistance

FEMA's compliance approach focuses on encouraging and promoting compliance, rather than threatening to penalize communities for non-compliance. FEMA provides training and technical assistance to help a community achieve compliant status. FEMA gives training both to the community floodplain managers who must administer the local floodplain ordinances and to FEMA floodplain management staff. Training is offered through FEMA's national training center, the Emergency Management Institute, local training events, conferences, workshops, webinars, home study courses, and guidance. Additionally, the Community Rating System (CRS) (discussed in Section 1.3.1.8) provides incentives to communities undertaking such training. FEMA also encourages its floodplain management staff and community partners to become certified floodplain managers through the Certified Floodplain Management program offered by the Association of State Floodplain Managers (ASFPM). This program, which was developed with input from FEMA staff, is a formalized procedure allowing individuals to demonstrate that they have a standardized level of knowledge and skills in floodplain management and a commitment to continual education in floodplain management.

FEMA also gives technical assistance to communities. Technical assistance takes many forms, including communication via phone and other contacts with NFIP communities, visits to communities, workshops, webinars, the issuance of procedural guidance, development of technical publications, and responding to inquiries. Technical assistance may be provided on a more formal basis through Community Assistance Contacts (CACs) and Community Assistance Visits (CAVs), as discussed below, or in response to specific inquiries by the communities. In order to reach a broader audience in less time, FEMA also offers workshops and webinars. Additionally, FEMA produces procedural guidance and technical publications, such as the *NFIP Guidance for Conducting CACs and CAVs* and the *NFIP Community Compliance Program Guidance* (FEMA, 2011b) (FEMA, 2016b).

Following major flood disasters, FEMA staff work closely with communities in providing technical assistance on the NFIP floodplain management requirements, such as the substantial damage requirement. FEMA also assists the community in developing a reconstruction strategy for property impacted by floods to determine appropriate mitigation measures, such as elevation, acquisition, demolition, or relocation of flood-damaged structures.

1.3.1.5 Compliance Monitoring

Once FEMA provides a community with the flood hazard information upon which floodplain management regulations are based, the community is required to adopt a floodplain management ordinance that meets or exceeds the minimum NFIP requirements. FEMA monitors communities to ensure that they have adopted an ordinance that meets or exceeds the minimum NFIP floodplain management criteria, and to ensure that they are effectively enforcing their ordinance. CACs and CAVs are a basic compliance monitoring tool and an opportunity for FEMA to provide NFIP technical assistance.

Typically, a telephone call or brief visit to an NFIP community, a CAC establishes or re-establishes contact with the community to determine if any program-related problems exist and to offer assistance. A CAC includes an overview of the community's floodplain management ordinances, procedures, and enforcement provisions. A CAC can be used (1) to monitor low risk communities (i.e., communities with relatively low development pressure) to determine if technical assistance or additional follow-up is required; (2) as a screening tool for determining whether a community should receive the level of attention of a CAV; and (3) as a follow-up to a CAV to ensure compliance issues have been resolved.

Example: FEMA's compliance monitoring and enforcement efforts are limited to instances of systemic programmatic compliance, as opposed to non-compliance of individual permits. For example, in 2014, FEMA conducted a CAV with Union County, SD, and cited several programmatic compliance issues that needed to be resolved. These issues included a non-compliant ordinance; permitting of residential structures with the lowest floor built below the Base Flood Elevation (BFE); lack of documentation related to the elevation of lowest floors in residential or non-residential structures; lack of documentation related to development in the regulatory floodway; the use of data for permitting that was not included in the FEMA published FIRM; and lack of documentation related to whether or not structures were substantially improved or substantially damaged.

FEMA provided technical assistance to the county multiple times during 2014. When documentation was not forthcoming, FEMA notified the county via letter on January 16, 2015, that the county would be placed on probation on May 18, 2015, if the documented issues were not resolved. Subsequently, FEMA notified insurance policyholders within the county of the potential probation and the potential for increased insurance surcharges should the county be put on probation. FEMA continued to provide technical assistance to the county, and, on May 13, 2015, FEMA signed a Corrective Action Plan with the county to detail the steps that the county would take to resolve the remaining identified issues, thus avoiding probation.

A CAV is a scheduled visit to an NFIP community to conduct a comprehensive assessment of the community's floodplain management program. A CAV typically involves a tour of the floodplain; a meeting with local floodplain management officials; a review of the community's floodplain management ordinances; an examination of the community's floodplain development permit and variance files; and a meeting with the community to discuss any identified deficiencies, offer technical assistance, help address any deficiencies, and identify good floodplain management practices. Following a CAV, the community has a reasonable amount of time to correct any program deficiencies and remedy any violations identified during the visit. As long as a community is making adequate progress toward correcting program deficiencies and remedying violations, FEMA will not initiate formal probation.

1.3.1.6 Compliance Enforcement

FEMA monitors communities to ensure that they have adopted an ordinance that meets or exceeds the minimum NFIP floodplain management criteria and to ensure that they are effectively enforcing their ordinance. If communities do not adequately enforce their floodplain management regulations, they can be placed on probation or suspended from the NFIP following probation (44 C.F.R. § 59.24(b)-(c)).

When potential programmatic compliance violations are reported to FEMA for further investigation, FEMA will notify the community. FEMA may also identify potential violations while conducting a CAC or a CAV. FEMA has an established process for pursuing compliance actions including technical assistance, probation, and finally suspension. Technical assistance provided to a community is often the best approach because it is a chance to provide education and find a programmatic solution that will prevent the violation from happening again. A physical violation must be mitigated to the maximum extent possible, and mitigation actions have to be approved by FEMA.

Most deficiencies in a community's floodplain management program or violations of local ordinances are due to lack of understanding of the NFIP requirements, lack of technical skills, failure to understand the rationale behind the NFIP requirements, or lack of an appreciation of the insurance implications and other consequences of a decision. Most problems that are identified can be solved through community assistance efforts.

Compliance actions will be taken if any violations are identified and not remedied to the maximum extent possible (44 C.F.R. § 59.24 (b)-(c)). When a community has demonstrated a pattern of failure to enforce the NFIP floodplain management requirements and FEMA has identified substantive program deficiencies or violations, FEMA may initiate an enforcement action against the community to obtain compliance. A substantive violation or program deficiency is one that has resulted, or could result, in increased potential flood damages or flood stages in the community and surrounding communities. When community assistance has failed to resolve a community's compliance problems, the NFIP may place the community on probation. When a community is placed on probation, a $50 surcharge will be added to the flood insurance policies of all policyholders in that community (44 C.F.R. §§ 59.24(b) and 61.16). Probation lasts for a minimum of one year and may be extended.

Additionally, a community that participates in the CRS (see Section 1.3.1.8) must be fully compliant with the NFIP minimum standards. A CRS community that is not fully compliant has an opportunity to remedy the violation to the maximum extent possible. If substantive program deficiencies or violations have not been remedied, the community will be retrograded to a CRS Class 10, which receives no flood insurance premium discounts.

Communities that do not comply while on probation can be suspended from the NFIP. Flood insurance is not available from FEMA in communities that have been suspended (44 C.F.R. § 59.24(c)). Suspension also means that the community will be unable to obtain many forms of disaster assistance when a community suffers a disaster. Additionally, lenders would not be able to provide loans backed by the Federal government for property located in the mapped SFHA if a community is suspended from the NFIP.

If an insured structure is identified as a violation of the community's floodplain management ordinance, FEMA can have the insurance company review the information and possibly rerate the structure to reflect the increased risk to the structure. This can result in significantly higher flood insurance rates on the structure, which may encourage the property owner to bring the building into compliance.

1.3.1.7 Removal of Insurance Eligibility

Pursuant to Section 1316 of the NFIA, FEMA may deny flood insurance coverage for any property in the SFHA that has been declared by an established State or local zoning authority, or other authorized public body, to be in violation of State or local floodplain management regulations (42 U.S.C. § 4023; 44 C.F.R. § 73.1). FEMA can only take a Section 1316 action upon request by the State or community; FEMA may not initiate such an action. This removal of insurance eligibility can act as a local enforcement action within the community to encourage a non-compliant property within the community to rectify the management issues.

1.3.1.8 Community Rating System

The NFIP CRS was implemented in 1990 as a voluntary program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards, and was codified under NFIRA (42 U.S.C. § 4022(b)). Any community in full compliance with the minimum NFIP floodplain management requirements may apply to join the CRS.

Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS:

- Reduce and avoid flood damages to insurable property
  - Protect public health and safety
  - Reduce damage to property
  - Prevent increases in flood damage from new construction
  - Reduce the risk of erosion damage
  - Protect natural and beneficial floodplain functions
- Strengthen and support the insurance aspects of the NFIP
  - Improve flood insurance policy coverage
  - Improve actuarial rating
- Foster comprehensive floodplain management
  - Protect natural floodplain functions
  - Address safety and health
  - Protect other community assets such as infrastructure, critical facilities, and open space

The CRS uses a class rating system to determine flood insurance premium reductions for residents. CRS classes are rated from 10 to 1 (highest). As a community engages in additional mitigation activities, community residents become eligible for additional NFIP premium policy discounts. Each class improvement produces an additional 5 percent discount in flood insurance premiums, with a Class 1 community receiving the maximum 45 percent reduction in flood insurance premiums. The CRS recognizes 19 creditable activities, organized by 4 categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. Some CRS activities for which communities may receive credit are environmentally protective, such as preserving open space or the natural and beneficial functions of floodplains,[7] or creating higher standards for stormwater management.

[7] The CRS Coordinator's Manual includes the CRS Schedule, which sets the criteria for CRS classification, and the CRS Commentary on the Schedule. Section 100 gives background information on the CRS. Section 200 explains the application and verification procedures. Sections 300 through 700 explain the credit points and calculations used to verify CRS credit. A community uses the procedures in these sections to submit a modification for a better CRS classification.

As of October 2015, more than 1,300 communities received flood insurance premium discounts based on their implementation of local mitigation, outreach, and educational activities that go beyond minimum NFIP requirements (FEMA, 2015a). Although premium discounts are one of the benefits of participation in the CRS, these communities are carrying out important activities that save lives, reduce property damage, and protect the natural and beneficial functions of floodplains. These 1,300-plus communities represent a significant portion of the nation's flood risk as evidenced by the fact that they account for approximately 70 percent of the NFIP's policy base.

1.3.1.9 Achieving Community Compliance

As discussed above, the NFIP compliance approach used by FEMA has three main components: (1) promotion of compliance, (2) monitoring of community programmatic compliance, and (3) enforcement. Within each of these components, FEMA has a number of tools to help the NFIP participating communities achieve compliance with the NFIP floodplain management regulations. These three components are essential to the process of achieving compliance, and FEMA often employs a number of the tools encompassed within these three components to achieve compliance (Table 1-1).

Table 1-1: Achieving Community Compliance with the NFIP

	Approaches/Components		
	Promoting Community Compliance	**Monitoring Community Compliance**	**Enforcing Community Compliance**
Tools	• Training • Technical Assistance (CACs, CAVs, procedural guidance, technical publications, response to inquiries, other) • Professional Certification • Incentives (insurance availability, CRS premium discounts, etc.) • Disincentives (loss of insurance availability, denial of insurance coverage (Section 1316), denial of disaster assistance, etc.)	• CACs, CAVs, meetings • CRS procedures • Community Information System (and data contained therein) • Submit-for-Rate Procedure • Complaints from citizens and others	• Technical Assistance • CRS Retrograde • Require Correction of Program Deficiencies (performed by community) • Require Remediation of Violations (performed by community) • Section 1316 Declaration—for individual structure violations (declaration by community; insurance denied by FEMA) • Legal action against owner of individual structure (only by community or State) • Probation • Suspension

In summary, FEMA's role is limited to setting the minimum criteria and then providing monitoring, oversight, and technical assistance to ensure that communities are complying with the NFIP program requirements.

1.3.2 Flood Hazard Mapping

Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. The NFIA requires that FEMA identify flood-prone areas and subdivide them into flood risk zones to provide the data necessary for FEMA to determine the appropriate minimum floodplain management criteria and to rate flood insurance policies. While a variety of flood zones are mapped on FIRMs, the 100-year flood (or 1-percent-annual-chance flood) is the standard used for implementation of the NFIP. Mapping of flood hazards promotes public awareness of the degree of hazard within such areas and provides for the expeditious identification and dissemination of flood hazard information. FEMA maintains and updates data through FISs and resultant FIRMs and FIS reports.

1.3.2.1 Flood Insurance Studies and Flood Insurance Rate Maps[8]

FEMA is required by statute to revise and update flood hazard maps (a) upon a determination that such revision or updates are necessary or (b) upon request from any State or community if accompanied by technical data sufficient to justify the requested change (42 U.S.C. § 4101(f)). To assess flood hazards in a community, FEMA conducts FISs and publishes FIS reports that describe the flood hazards for the community. FEMA uses the information developed in the FIS to prepare FIRMs. FEMA publishes the FIRM for distribution to a wide range of users: private citizens, community officials, insurance agents and brokers, lending institutions, and other Federal agencies. The FIRM is the basis for the floodplain management, insurance, and mapping activities of the NFIP.

1.3.2.2 Non-Regulatory Products and Features

FEMA provides other data layers and information to facilitate improved flood risk management and communication at the local level. Unlike regulatory flood hazard products (such as the FIRM, FIS report, FIRM database), non-regulatory products are not intended to be used as the basis for official actions required under the NFIP, such as determining the insurance rate for a property or enforcing minimum building standards for construction in a floodplain. These products work alongside regulatory products to provide additional flood risk information and to support a community's overall floodplain management and hazard mitigation strategies and plans. There are also two key non-regulatory features, the Limit of Moderate Wave Action (LiMWA) and future conditions layers on existing FIRMs. Although these do not exist as separate products because they are placed on the actual FIRM, these are considered non-regulatory features because they are not associated with any regulatory requirements under the NFIP (although communities may, and do, choose to regulate based on these non-regulatory features).

- LiMWA: Dangerous flood hazards can exist in coastal areas affected by waves equal to or greater than 1.5 feet in height during the 1-percent-annual-chance flood. FEMA now delineates the LiMWA, which depicts the portion of the SFHA where base flood wave heights are between 1.5 feet and 3 feet, on all new coastal risk mapping, assessment, and planning (Risk MAP) studies to assist communities interested in voluntarily applying V-zone requirements in those areas.
- Future Conditions Maps: At the request of the community, FEMA may indicate zones to identify areas of future-conditions flood hazards (44 C.F.R. § 64.3). The future conditions flood hazard information is provided for informational purposes only, and it is up to the community to decide whether to use the information to regulate floodplain development.

[8] Covers the first two Flood Hazard Mapping components in Table 2-1.

1.3.2.3 Map Sequencing

The FEMA Risk MAP Program is allocated a budget each year by Congress. With that budget, FEMA must meet regulatory requirements; respond to stakeholder correspondence; distribute flood hazard data products; establish and maintain cost and schedule controls; track and monitor performance; support the development of State and local capabilities through the Cooperating Technical Partners program; and carry out other core program functions. These core functions utilize a significant portion of the budget.

The remaining funds are allocated to the overall program priorities established by the administration in the President's budget. Since 2009, one of the major budgetary commitments has been to update the maps for 100 percent of the populated coastline. In recent years, FEMA also has significant commitments to update analyses and maps affected by flood protection systems. The remaining budget is allocated to addressing other needs. Congress often establishes mapping priorities from year to year in appropriations legislation. FEMA must incorporate those priorities in determining how to allocate funding to specific mapping activities.

Risk MAP is addressing mapping needs by watershed. The overall guiding principle for Risk MAP project selection is that watersheds are prioritized for update based on both the level of flood risk and the need for flood hazard data updates. Risk MAP has developed an estimate of flood risk across the country and has tools that allow staff to rank watersheds based on this flood risk estimate. Risk MAP also has a system called the Coordinated Needs Management System for tracking flooding sources for which an updated flood hazard map is needed.

1.3.2.4 Letters of Map Change

FEMA can also revise or amend maps through a Letter of Map Change (LOMC). FEMA issues a number of LOMCs, including the Letter of Map Amendment (LOMA), Letter of Map Revision (LOMR), and Letter of Map Revision based on Fill (LOMR-F). A LOMR is FEMA's modification to an effective FIRM based on the implementation of physical measures that affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of an existing regulatory floodway,[9] the effective Base Flood Elevations (BFEs), or the SFHA. A LOMR-F is a revision to the effective FIRM that establishes whether a specific property, or specific structure on the property, is located in an SFHA based on the placement of fill. In addition, there are limitations imposed by the scale at which the maps are prepared, which may result in individual properties being inadvertently included in SFHAs. FEMA has developed a process, referred to as a LOMA, to correct these inadvertent inclusions. A LOMA is issued pursuant to an administrative procedure that involves the review of technical data submitted by the owner of property who believes the property has incorrectly been included in a designated SFHA. A LOMA establishes whether a specific property, or a specific structure on the property, is or is not located in an SFHA.

NFIP regulations require FEMA to revise and amend maps and FIS reports as warranted or in response to requests from community officials and individual property owners. In making revisions and amendments, FEMA must adhere to the same engineering standards applied in the preparation of the original FIRMs

[9] The regulatory floodway is the channel that must be kept clear of obstructions to allow passage of the 1-percent-annual-chance flood without causing the water surface elevation to rise beyond a designated height in the SFHA.

and FIS reports. Therefore, when requesting changes to FIRMs and FIS reports, community officials and property owners are required to submit adequate supporting data. Those data enable FEMA to review and evaluate the requests and to carry out its responsibility of ensuring that the flood-risk information presented is scientifically and technically correct.

1.3.2.5 Conditional Letters of Map Change

Because LOMAs, LOMR-Fs, and LOMRs officially amend or revise the flood maps, they must reflect existing conditions, such as an "as-built" project. However, communities, developers, and property owners may submit requests for proposed projects in floodplain areas to FEMA for review and comment before any physical development occurs. A Conditional Letter of Map Revision (CLOMR) is a FEMA letter commenting on a proposed project that would, if built as proposed, affect the hydrologic or hydraulic characteristics of a flooding source, and thus result in the modification of the effective regulatory floodway, BFEs, and/or the SFHA. A Conditional Letter of Map Revision based on Fill (CLOMR-F) is a FEMA letter commenting on whether a parcel of land or proposed structure that will be elevated by fill would be inundated by the base flood if fill is placed on the parcel as proposed or the structure is built on fill as proposed. A Conditional Letter of Map Amendment (CLOMA) is a FEMA letter commenting on whether a parcel of land or proposed structure would be inundated by the base flood if built as proposed.

A CLOMR, CLOMR-F, or CLOMA does not constitute a building permit or approval. The authority to approve projects and issue building permits lies with the local community and, in some instances, State agencies.

On October 19, 2015, FEMA released a memorandum providing clarifying guidance on reviewing and processing CLOMRs and CLOMR-Fs (FEMA, 2015b). Specifically, this memorandum clarified a requestor's responsibilities for documenting ESA compliance when requesting CLOMRs and CLOMR-Fs.

FEMA requires the ESA compliance to be documented for all CLOMR and CLOMR-F applications prior to issuing a comment. The CLOMR/CLOMR-F request will not be processed by FEMA until FEMA receives this documentation. Unless FEMA is directly involved with the project's construction or funding (e.g., through a FEMA grant), documentation of ESA compliance should be obtained without FEMA's involvement.

For projects with Federal construction, funding, or permitting, before FEMA will issue a CLOMR or CLOMR-F, documentation of a "No Effect" determination from the Federal action agency, a "not likely to adversely affect" determination by the Federal action agency with concurrence from the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NFMS), collectively referred to as the Services, or other approval from the Services is required.

For non-Federal actions, the CLOMR/CLOMR-F request will be processed by FEMA only after FEMA receives documentation of compliance with the ESA from the requestor. For these projects, the requestor must document that a "take"—meaning to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct—will not occur to threatened and endangered species as a result of the project. If a project has the potential to "take" listed species, an Incidental Take Permit may be submitted with documentation showing that the proposed project is the subject, or is covered by the subject, of the permit.

Notably, there were 628 CLOMRs and CLOMR-Fs issued in 2015 (FEMA, 2016c). FEMA reviewed and categorized a sample of CLOMRs and CLOMR-Fs to estimate the ESA compliance burden for communities and project proponents relating to the proposed private floodplain development for which a CLOMR or CLOMR-F is sought. FEMA found "that in 46 percent (121/261) of the sample, no ESA-listed species or designated critical habitat were present; in 43 percent (112/261) of the sample, ESA-listed species or designated critical habitat were present, but there were no direct, indirect, or cumulative adverse impacts; and in 11 percent (28/261), of the sample, ESA-listed species or designated critical habitat were present," and there were direct, indirect, or cumulative adverse impacts for which additional ESA compliance measures were necessary (FEMA, 2015c).

1.3.2.6 Letter of Determination Review

A Letter of Determination Review (LODR) is an option available to a property owner to appeal a lender's flood zone determination. The request can be made to FEMA, at a current cost of $80, jointly by a lender and borrower within 45 days of the notice to the borrower that the building is located within the SFHA by the lender. The LODR review process enables FEMA to verify whether the building's location was correctly identified on the applicable FIRM. A successful LODR releases the lender from the statutory obligation to require the purchase of flood insurance and identifies the building in a low to moderate flood risk area. However, lenders retain the prerogative to require flood insurance absent the Federal requirement, but as a regulatory safety and soundness measure. This process does not consider the elevation of the structure above the flood level. It considers only the location of the structure relative to the SFHA shown on the effective FIRM.

1.3.2.7 Data Dissemination

Under the NFIA, as amended, FEMA is required by Congress to identify flood-prone areas and to subdivide these areas into flood risk zones to promote public awareness of the degree of hazard within such areas, and to provide for the expeditious identification and dissemination of flood hazard information (42 U.S.C. § 4101). Typically, data dissemination includes publication of flood hazard data on FEMA's website and distribution to communities when new flood hazard data becomes available.

1.3.2.8 Community Outreach, Training, and General Technical Assistance

FEMA encourages and promotes the NFIP by providing outreach, training, and technical assistance. FEMA provides training through webinars and in person trainings to a wide stakeholder audience. Technical assistance can include phone and other contacts with stakeholders, workshops, webinars, the issuance of procedural guidance, development of technical publications, and responding to inquiries.

1.3.2.9 Mapping Standards, Policies, and Regulations

To assure accuracy and consistency nationwide, FEMA has established standards for flood map studies, as well as the associated coordination and documentation activities. FEMA has also established product specifications for FIS reports, maps, and related NFIP products. These standards are provided in FEMA Policy FP 204-078-1: Standards for Flood Risk Analysis and Mapping (FEMA, 2013c). The product specifications are published as separate technical reference documents. These documents are available at http://www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping. In addition, FEMA provides supplemental guidance to support implementation of the standards. This guidance is a recommended method to meet the standard. However, acceptable approaches are not limited to this recommended method; mapping partners may use other methods to meet or exceed the standard.

FEMA's Guidelines and Standards Steering Committee (GSSC) oversees and manages the maintenance and update process for FEMA's standards for flood map studies based on insights from internal and external stakeholders, such as advisory groups. The GSSC will perform preliminary reviews and research of proposed program enhancements to inform resource and staffing decisions, identifying appropriate staff experts and estimating levels of effort. More information on FEMA's guidance and standards maintenance update process can be found at https://www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping.

FEMA also has a number of regulations establishing its process for identification of flood hazards (e.g., 44 C.F.R. §§ 64, 65, 67, 70, and 72). When changes to FEMA's mapping related regulations are received, and determined to be appropriate to implement, FEMA must comply with a statutory process that would be initiated to assess costs, determine impacts, and receive stakeholder input.

1.3.2.10 Depiction of Levees and Coastal Structures on FIRMs[10]

FEMA does not certify, design, construct, permit, or otherwise approve levees, levee systems, or floodwalls. However, FEMA has criteria that must be met before any levee, levee system, or floodwall can be depicted on a FIRM as reducing the risk of the 1-percent-annual-chance flood, also referred to as the base flood (criteria are found in 44 C.F.R. § 65.10). To be depicted on a FIRM as providing protection for the base flood, or accredited, the community or other party must provide FEMA with specific data certified by a registered engineer or a Federal agency with responsibility for levee design demonstrating the levee, levee system, or floodwall reduces the risk of the base flood. FEMA's review of this data is "for the sole purpose of establish[ing] appropriate risk-zone determinations for NFIP maps" and does not "constitute a determination or warranty by FEMA as to how a structure or system will perform in a flood event." FEMA only recognizes a levee, levee system, or floodwall that meets, and continues to meet, the minimum design, operation, and maintenance criteria established in 44 C.F.R. § 65.10. These requirements must be satisfied before such a structure may be accredited and then mapped, typically through the LOMR process, as reducing the risk of the 1-percent-annual-chance flood event (44 C.F.R. §§ 65.10 and 65.2).

1.3.2.11 Zone A99 Determinations

Federal and State agencies, and communities, may design and build new levee systems, or they may restore the flood risk-reduction capability of existing levee systems, to reduce flood risks in a particular community or particular area of a State. When these types of projects meet certain milestones, a community may choose to submit the appropriate data and documentation to FEMA and request an

[10] Also covers levee accreditation.

"adequate progress" determination. To establish eligibility for an "adequate progress determination," the community must show that:

- 100 percent of the total financial project cost of the completed flood control system has been authorized;
- At least 50 percent of the total financial project cost of the completed flood control system has been expended;
- At least 60 percent of the total financial project cost of the completed flood control system has been appropriated;
- All critical features of the flood control system, as identified by FEMA, are under construction, and each critical feature is 50 percent completed as measured by the actual expenditure of the estimated construction budget funds; and
- The community has not been responsible for any delay in the completion of the system (42 U.S.C. § 4014(e); 44 C.F.R. § 61.12).

If the community meets the above criteria and FEMA makes an adequate progress determination, FEMA is statutorily required to change the zone designation to Zone A99 for the levee-impacted area by updating the FIRM panels, typically by issuing a LOMR, and applying the flood insurance premium rates that would be applicable when the project is completed (42 U.S.C. § 4014(e)). However, the mandatory flood insurance purchase requirement is still in effect for areas receiving the designation change, and the floodplain management criteria still apply to these areas (44 C.F.R. § 60.3(f)).

1.3.2.12 AR Zone Determinations

Participating communities, as well as Federal and State agencies, may restore the flood protection and risk reduction capability of existing levee systems to reduce flood risks in a particular community or particular area of a State. When such projects involve restoration of a levee system that meet the criteria in 44 C.F.R. § 65.14, a community may choose to submit the appropriate data and documentation to FEMA and request that FEMA make a "flood protection restoration" determination.

Zone AR is a flood insurance risk zone designation that may be used by FEMA to identify flood risk on a FIRM in areas where a flood protection system (i.e., levee system) previously credited with providing protection against the 1-percent-annual-chance or greater level of flood protection no longer provides that level of protection (42 U.S.C. § 4014(f)).

A community may choose to submit data and documentation to request that FEMA issue a "flood protection restoration" determination and revise the affected FIRM to show the levee-impacted area landward of the levee system as Zone AR when they are engaged in the process of restoring a flood control system that was:

- Previously recognized as providing risk reduction to the 1-percent-annual-chance flood on an effective FIRM, and
- Decertified by a Federal agency responsible for flood protection design or construction (44 C.F.R. § 65.14).

If the community meets these requirements and FEMA makes a "flood protection restoration" determination, FEMA is statutorily required to change the zone designation of the levee-impacted areas by updating the FIRM panels, typically by issuing a LOMR, and applying the flood insurance premium rates applicable to Zone AR. However, the mandatory flood insurance purchase requirement is still in effect for areas receiving the zone designation change, and the floodplain management criteria still apply to these areas. (44 C.F.R. § 60.3(f))

1.3.3 Flood Insurance

Since its enactment in 1968, the NFIA has made flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. The risk zones shown on the FIRMs are the basis for the establishment of premium rates for flood coverage offered through the NFIP.

As originally established, the NFIA authorized FEMA to provide subsidized flood insurance for existing buildings or buildings built prior to the community's first FIRM (generally referred to as "pre-FIRM buildings"). Notably, flood insurance for new development has never been subsidized by the NFIP (subject to the very limited, short-term exceptions established in 42 U.S.C. § 4014(e)-(f)).

However, subject to the very limited, short-term statutory exceptions referenced above, FEMA must apply actuarial rates to all buildings constructed, or substantially damaged or improved, on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later (generally referred to as "post-FIRM buildings") (42 U.S.C. §§ 4014(a)(1), 4015(b)).

As discussed above, with the passage of the BW-12 and HFIAA, FEMA is required to phase out the subsidies on pre-FIRM properties. Some subsidies must be phased out immediately, some will be phased out at a rate of 25 percent premium rate increases per year, and the rest will be phased out at a rate of 5 percent to 15 percent premium rate increases per year. Accordingly, when this phase out is completed, FEMA will not offer subsidized flood insurance for either new or existing floodplain development (subject to certain limited, short-term statutory exceptions).

1.3.3.1 Administer Write-Your-Own Program

FEMA's Write-Your-Own (WYO) Program allows participating property and casualty insurance companies to write and service NFIP flood insurance policies in their own names. The WYO Program, which is currently found in 44 C.F.R. Part 62, Subpart C, is a cooperative undertaking of the insurance industry and FEMA. The WYO insurers retain an expense allowance (which includes agents' commissions) and remit the remaining premium to the Federal government. The WYO insurers pay flood losses and loss adjustment expenses based on a fee schedule. Both are paid through the regulated access of Federal funds; the WYO companies do not pay flood losses or loss adjustment expenses out of their own funds. In addition, under certain circumstances, reimbursement for litigation costs, including court costs, attorney fees, judgments, and settlements, are paid by FEMA based on documentation submitted by the WYO insurers.

1.3.3.2 Develop and Publish Flood Insurance Rate Tables

The development of insurance rate tables is based on insurance risk calculations and the predicted damage to a specific building type in a specific hazard area. The type and elevation of a building, along with the hazard zone that the building is located in, will determine the flood insurance premium rate. The publication of insurance premium rate tables is an administrative action that includes application of the already-implemented premium rate increases required by BW-12 and HFIAA, such as:

- Immediate removal of subsidies for lapsed policies that are reinstated; and
- Setting premium rates for certain properties newly mapped into the SFHA at the same rate as Preferred Risk Policies, after which full risk rates will be phased in.

1.3.3.3 Application of Reserve Fund Assessment HFIAA Surcharge, and Federal Policy Fee

As described in Section 1.1.1, FEMA, or the WYO companies on FEMA's behalf, apply a Reserve Fund Assessment and a HFIAA-imposed surcharge on NFIP policies. Additionally, as authorized by the NFIA, FEMA imposes a Federal Policy Fee on all policies, which is a flat charge that the policyholder must pay on each new or renewal policy to defray certain administrative expenses incurred in carrying out the NFIP.

1.3.3.4 Flood Insurance Policy Administration

FEMA, or the WYO companies on FEMA's behalf, issue, sell, renew, process refunds, and process appeals for NFIP flood insurance policies. Policies are rated based on the published insurance premium rate tables for specific building types and flood hazard areas. Flood insurance is available to property owners and lessees in communities that participate in the NFIP. Flood insurance is typically provided once construction has been completed on an insurable structure.

1.3.3.5 Educate Insurance Agents/Educate and Certify Claims Adjusters

Property owners and lessees in NFIP participating communities typically acquire flood insurance through local insurance agents, who service the flood insurance policy. If there is a loss on the policy, a claims adjuster, typically an independent contractor will adjust the claim. FEMA provides education to insurance agents and claims adjusters on topics related to selling, issuing, renewing, processing premium refunds for, and adjusting the claims of NFIP flood insurance policies, as well as other flood insurance-related topics.

1.3.3.6 Adjust/Pay Loss Claims

When a loss is reported, FEMA and the WYO companies, based on the recommendations of the claims adjusters, must determine the amount of damage to the buildings and/or contents, whether or not the damage was caused by flooding, and the appropriate payout under the insurance policy.

1.3.3.7 General Technical Assistance

FEMA provides general technical assistance on insurance related topics as needed to agents, WYO companies, adjusters, policyholders, and other stakeholders. This technical assistance can include bulletins, guidance, webinars, and responding to inquiries.

1.3.3.8 Marketing

FEMA has a public marketing campaign through FloodSmart to educate the public on the risk of flooding and the availability of flood insurance through the NFIP. Information about the campaign can be found at https://www.floodsmart.gov.

1.4 ACTIONS NOT INCLUDED AS PART OF NFIP IMPLEMENTATION

Floodplain development is not an action under the NFIP. Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does the NFIP encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. As discussed above, the NFIP was designed so that floodplain management would be carried out at the State and local levels, where land use authority resides. The community regulates floodplain development through locally issued floodplain development permits. The community has the authority to issue or deny floodplain development permits. Likewise, the community monitors compliance and enforcement of individual permits. Therefore, private floodplain development and the issuance, denial, and enforcement of individual permits are not actions taken under the NFIP.

1.5 STATUTORY AND REGULATORY FRAMEWORK

1.5.1 National Environmental Policy Act

FEMA is preparing this NPEIS in accordance with NEPA, the Council on Environmental Quality's (CEQ) *NEPA Implementing Regulations* (40 C.F.R. §§ 1500-1508), and FEMA's NEPA procedures (*Directive 108-1: Environmental Planning and Historic Preservation Responsibilities and Program Requirements* and *Instruction 108-1-1: Instruction on Implementation of the Environmental Planning and Historic Preservation Responsibilities and Program Requirements*) hereinafter referred to as Directive and Instruction. FEMA has determined that the NEPA analysis for the Alternatives should be conducted at a nationwide programmatic level. A programmatic environmental document, such as this NPEIS, is prepared when an agency is proposing to carry out a broad action, program, or policy.

FEMA has determined that the decision on the future program modifications to the NFIP included in the Alternatives discussed below is a proposed Federal action requiring preparation of a NPEIS. This NPEIS fulfills FEMA’s requirements under NEPA to consider potential environmental impacts of the Alternatives and assists in the decision-making process on future program modifications to the NFIP.

1.5.2 Tiered Analysis

As stated above, a programmatic environmental document, such as this NPEIS, is prepared when an agency is proposing to carry out a broad action, program, or policy (40 C.F.R. § 1502.4(b)). As described in the CEQ guidance entitled *Effective Use of Programmatic NEPA Reviews*, in cases where a policy, plan, or program analysis identifies, but does not provide sufficiently in-depth analysis for potential future actions, then subsequent analyses are appropriate and referred to as "tiered" analyses (CEQ, 2014). "Programmatic NEPA reviews assess the environmental impacts of proposed policies, plans, programs, or projects for which subsequent actions will be implemented either based on the Programmatic Environmental Assessment [PEA] or Programmatic Environmental Impact Statement [PEIS], or based on subsequent NEPA reviews tiered to the programmatic review..." (CEQ, 2014).

The subject of this Final NPEIS is the NFIP, and since it is an ongoing program, and not a new program, there are many possible changes to the program that can and will be made and for which additional NEPA analysis is needed. This NPEIS provides a baseline analysis of the environmental impacts of the NFIP, as well as the impacts of implementing certain changes required by BW-12 and HFIAA and demonstrating compliance with the ESA.

While the program changes included in this NPEIS are currently ripe for NEPA analysis, there are other program changes that will be made to the NFIP in the future that are not addressed by this NPEIS and for which a tiered NEPA analysis may be appropriate. Such program changes may include, but are not limited to, legislative changes, including legislative changes associated with a bill to reauthorize the NFIP, program changes made to implement the recommendations of the TMAC, program changes resulting from the National Marine Fisheries Service's recommendations in its Biological Opinion on the implementation of the NFIP in Oregon, or program changes to implement reasonable and prudent alternatives recommended in future biological opinions.

1.5.3 Integration of Other Environmental Laws and Regulations

According to CEQ regulations (40 C.F.R. § 1500.4(k) and 40 C.F.R. § 1502.25), NEPA requirements should be integrated with "other planning and environmental review procedures required by law or by agency so that all such procedures run concurrently rather than consecutively." The NEPA process does not replace the procedural or substantive requirements of these laws or regulations. Rather, it addresses them collectively so that decision makers have a comprehensive view of the major environmental issues and requirements associated with each alternative.

As a result, an agency's decision on whether to proceed with an action would occur within the context of numerous environmental laws, including the ESA (see Section 3.7.2.2), implementing regulations, and Executive Orders (EO) that establish standards and provide guidance on environmental and natural resources management and planning. A list of regulations, laws, and EOs that may apply to the Alternatives are presented by resource in Chapter 3 and included in Appendix A.

1.6 INTERAGENCY AND PUBLIC INVOLVEMENT

1.6.1 Interagency Coordination

FEMA is the lead Federal agency in preparing this analysis. Cooperating agencies, as defined by the CEQ, include any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in proposed legislation, a proposed action, or reasonable alternative (40

C.F.R. § 1508.5). A cooperating agency assists the lead Federal agency by participating in the NEPA process and typically has some responsibilities for the review of impacts related to its jurisdiction or special expertise. The United States Environmental Protection Agency (EPA) formally accepted the responsibility of a cooperating agency to provide subject matter expertise in the review of this NPEIS.

1.6.2 Public Involvement

FEMA encourages public participation in the NEPA process. Public involvement allows for full and fair discussion of significant environmental impacts and complies with NEPA, CEQ regulations, and FEMA's Directive and Instruction. The purpose of public involvement under NEPA is to provide open communication between FEMA and the public. Consideration of the views and information of all interested persons promotes open communication and enables better decision-making. All agencies, organizations, and individuals with an interest in the NFIP are encouraged to participate in the NEPA public participation process.

FEMA provided several opportunities for public involvement during the preparation of this NPEIS. This section provides an overview of the scoping process and comments received. Scoping is the first phase of the NEPA analysis process and is intended to give interested parties the chance to comment on the alternatives and offer suggestions about the issues to be considered in an environmental impact statement analysis. FEMA encouraged interested Federal, State, and local agencies; Native American Tribes; private-sector organizations; and the public to participate in the scoping process. Scoping identifies relevant issues early in the NEPA process and helps ensure that the alternatives are thoroughly developed.

FEMA published several notices in the *Federal Register* (FR) and notified thousands of Federal, State, and local government officials; non-governmental organizations; and the public about the scoping opportunities. In addition, FEMA developed a project website to disseminate information to the public; the project website is available at http://www.fema.gov/programmatic-environmental-impact-statement. Throughout the NPEIS development process, the public can obtain information on the status of the NPEIS through the project website. Interested parties may request to be added to the email distribution list at NFIP-Programmatic-EIS@fema.dhs.gov.

FEMA has conducted a variety of in person meetings, virtual webinars, and public notifications to solicit input on the issues, concerns, and alternatives related to the NFIP. During these outreach activities, FEMA accepted verbal and written comments.

FEMA held an NFIP Listening Session on November 5-6, 2009, in Washington, DC. The goals of the listening session were to engage invited stakeholders to discuss key issues facing the program, identify common understandings between groups, and document the diversity of opinions concerning the optimum implementation of the NFIP. The two-day listening session included breakout sessions attended by more than 170 participants composed of representatives from Federal, tribal, State, and local governments; non-governmental organizations; and the private sector. In addition, FEMA accepted written comments until January 31, 2010, via http://regulations.gov, to allow the public to submit comments for inclusion in future analysis efforts. The session resulted in nearly 1,500 comments and recommendations from stakeholders. FEMA reviewed the comments received, which culminated in a report titled *Content Analysis of Breakout Session Comments* (FEMA, 2010a).

FEMA formally established the NFIP Reform Working Group in March 2010 to lead a multi-phase participatory process designed to review, rethink, and reform the NFIP. Consisting of a cross-section of FEMA's NFIP staff, this internal working group incorporated the recommendations and themes resulting from the NFIP Listening Session and web comments to guide the NFIP reform effort. In May 2010, the NFIP Reform Working Group released a final report titled *NFIP Reform: Phase II Report* (FEMA, 2010b).

The NFIP Reform Working Group reviewed a comprehensive body of work on the NFIP, including reports by the Government Accountability Office (GAO), the Congressional Research Service, and the DHS Office of the Inspector General; testimony before Congressional committees; proceedings of various policy meetings; policy papers published by industry, advocacy groups, and professional associations; and scholarly works. In addition, FEMA reached out to other Federal agencies for input. For example, FEMA solicited ideas from a number of different Federal agencies through the Federal Interagency Floodplain Management Task Force, a group of 12 Federal agencies brought together to promote the health, safety, and welfare of the public by encouraging programs and policies that reduce flood losses and protect the environment.

Based on this research and stakeholder input, the NFIP Reform Working Group drafted a number of policy options for deliberation and public comment. In December 2010, FEMA held two public meetings and initiated a public comment period to solicit input from stakeholders on the policy options. Public input from these efforts served as a source for refining the policy alternatives. Over 150 stakeholders attended the public meetings, and FEMA received 84 additional comments on specific policy options.

1.6.3 Public Notification

Development of the NFIP NPEIS began with publication of the Notice of Intent in the *Federal Register* on May 16, 2012 (77 FR 28891–28893) (Docket ID FEMA-2012-0012). FEMA received 39 comments. Due to the extenuating circumstances caused by the passage of BW-12, interested parties requested an extension of the initial comment period. FEMA reopened the comment period for submitting public comments from July 16, 2012, through October 9, 2012 (77 FR 50706). Two additional comments were received. Commenters included Federal, State, and local agencies; environmental organizations; and individual citizens.

On March 25, 2014, FEMA published a notice in the *Federal Register* (79 FR 6525) to publicize the dates of three public scoping webinars. The virtual webinars were held on April 22, 2014 (2:00 to 4:00 p.m. Eastern Standard Time [EST]), and May 13, 2014, and May 20, 2014 (4:00 to 6:00 p.m. EST). These webinars informed the public about the NFIP NPEIS and allowed interested parties to provide comments on the project.

On April 7, 2017, FEMA published a Notice of Availability (NOA) of the Draft NPEIS and notice of public meetings in the *Federal Register* (82 FR 17023–17025). FEMA distributed email announcements to (1) interested parties who expressed interest in the NPEIS from scoping meetings or commented during the scoping period; (2) FEMA’s Tribal Listserv; and (3) Congress and congressional staff via Congressional Affairs. The public meetings and webinars were also announced in FEMA Bulletin, a weekly online newsletter distributed via email to over 57,000 email recipients and available on the

FEMA.gov Web site at https://www.fema.gov/fema-bulletin. Announcements were published on a weekly basis via the FEMA Bulletin until the comment period closed. Publication of the NOA and Draft NPEIS included a 60-day public comment period that ended June 6, 2017.

1.6.4 Scoping Meetings

As described in Sections 1.6.2 and 1.6.3, in addition to the public meetings held in support of the NFIP Reform Effort, FEMA conducted three public webinar meetings held on April 22, May 13, and May 20, 2014. Each of the virtual webinar meetings started with a project overview presented by the FEMA NFIP NPEIS Program Manager. This presentation included a discussion of the following: the history of the NFIP; the NFIP as it is today; alternatives under consideration, and the NEPA process. After the presentation, the webinar allowed for a comment period where attendees could provide verbal comments.

Over 100 people registered to attend one of the three webinars. Sixty-five people participated in the webinar meetings with 12 individuals providing verbal comments for FEMA's consideration. Additionally, FEMA received written comments from seven individuals and organizations and three comments via telephone. In addition, interested members of the National Association of Flood and Stormwater Management submitted six verbal comments on May 7, 2014. FEMA also held a cooperating agency teleconference meeting with EPA staff on May 29, 2014; EPA staff provided 10 verbal comments.

1.6.5 Public Meetings

With FEMA's publication of the Draft NPEIS NOA on April 7, 2017, FEMA announced the schedule for six public meetings and three webinar meetings held in April and May 2017. The in person public meetings were held in Brooklyn, NY (April 20, 2017); New Orleans, LA (April 25, 2017); Fort Lauderdale, FL (April 27, 2017); Portland, OR (May 10, 2017); Kansas City, MO (May 17, 2017); and Washington, DC (May 19, 2017). The webinars were held on April 19, April 26, and May 9, 2017. Each of the meetings and webinars started with a project overview presented by the FEMA NFIP NPEIS Program Manager. The presentation included a summary of the NEPA process, the history of the NFIP, proposed alternatives, and potential impacts to environmental resources areas, and included an opportunity for attendees to provide written or verbal comments. A total of 35 people attended the NFIP Draft NPEIS in person meetings or webinars. FEMA received 31 comments during the 60-day comment period.

1.6.6 Agency and Public Comments

FEMA reviewed and considered the content of all comments received on the Draft NPEIS. The main comment themes are provided below:

- Comments regarding FEMA's land use authority and its legal authorities generally;
- Comments related to FEMA's relationship to private floodplain development and its impacts;
- Comments related to addressing climate change and impacts from climate change;
- Statements about the need to conduct Section 7 consultation for the actions proposed in the NFIP Draft NPEIS;

- Suggestions for additional program changes the NFIP should make, such as changes to FEMA's mapping program, changes to FEMA's floodplain management criteria to include energy efficiency requirements, incorporation of additional ESA compliance measures, and implementation of the TMAC recommendations;
- Statements in support of or against the proposed alternatives; and
- Comments about how the NPEIS and/or implementation of the alternatives analyzed in the NPEIS affect implementation of the Reasonable and Prudent Alternative in the Oregon Biological Opinion.

All meeting materials, including the *Federal Register* notice and presentation for the Draft NPEIS, are included in Appendix B. Publication of the Draft NPEIS included a 60-day public comment period.

REFERENCES

CEQ. (2014). *Effective Use of Programmatic NEPA Reviews.* Retrieved August 2017, from https://energy.gov/sites/prod/files/2016/05/f31/effective_use_of_programmatic_nepa_reviews_18dec2014.pdf

CEQ. (2016, August 5). *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change*. Retrieved from https://www.federalregister.gov/documents/2016/08/05/2016-18620/final-guidance-for-federal-departments-and-agencies-on-consideration-of-greenhouse-gas-emissions-and

FEMA. (2010a). *Content Analysis of Breakout Session Comments.* Retrieved from http://www.fema.gov/pdf/business/nfip/nfip_breakout_session_content_analysis.pdf

FEMA. (2010b). *NFIP Reform: Phase II Report.* Retrieved from http://www.fema.gov/txt/business/nfip/nfip_reform_phase_II_report.txt

FEMA. (2011a, March). *National Flood Insurance Program: Answers to Questions about the NFIP*. Retrieved from https://www.fema.gov/media-library/assets/documents/272

FEMA. (2011b, April). *Guidance for Conducting Community Assistance Contacts and Community Assistance Visits.* Retrieved from National Flood Insurance Program (NFIP) FEMA F-776: http://www.fema.gov/media-library-data/20130726-1812-25045-9789/fema_f776_cacs__cavs__web__final_apr2011.pdf

FEMA. (2013a). *Written testimony, FEMA Administrator Craig Fugate, hearing titled "Implementation of the Biggert-Waters Flood Insurance Reform Act of 2012: One Year After Enactment.* Retrieved January 2015, from Department of Homeland Security News: http://www.dhs.gov/news/2013/09/18/written-testimony-fema-administrator-craig-fugate-senate-banking-housing-and-urban

FEMA. (2013b). Community Rating System (CRS); CRS Communities Receiving Credit by Activity and Element (2007 - 2013).

FEMA. (2013c, August 22). *Standards for Flood Risk Analysis FP 207-078-1*. Retrieved from Federal Insurance and Mitigation Administration Policy: https://www.fema.gov/media-library-data/445f109e9cd88ea083891aa196a51167/Policy+Memo+-+Standards+for+Flood+Risk+Projects.pdf

FEMA. (2014, October 1). April 1, 2015, Program Changes. Washington, D.C.

FEMA. (2015a, October). *CRS Class Rating.* Retrieved from CRS Class Rating as of October 1, 2015: http://www.fema.gov/media-library-data/1445271112005-260161604f6df628e6998e1eecb597ee/CRS_Oct-2015-Data.pdf

FEMA. (2015b, October 19). *Endangered Species Act and Review/Processing of CLOMR-Fs and CLOMRs.* Retrieved from http://www.ncfloodmaps.com/lomc/pdf/documents/endangered_species_act_and_review_processing_of_clomr-fs_and_clomrs.pdf

FEMA. (2015c, February 15). *Regulatory Evaluation for Notice of Proposed Rule Updates to the NFIP to Facilitate Improved Endangered Species Act Compliance.* Washington DC: FEMA. Retrieved from Office of General Counsel.

FEMA. (2016a). *Communities Participating in the National Flood Program (Nation)*. Retrieved November 2016, from The National Flood Insurance Program Community Status Book: https://www.fema.gov/cis/nation.pdf

FEMA. (2016b, June). *Community Compliance Program*. Retrieved from https://www.fema.gov/community-compliance-program

FEMA. (2016c). FEMA Mapping Information Platform. Washington, DC, USA. Retrieved from https://hazards.fema.gov/femaportal/wps/portal

King, R. O. (2013, February 6). *Congressional Research Service, The National Flood Insurance Program: Status and Remaining Issues for Congress.* Retrieved from Congressional Research Service: http://fas.org/sgp/crs/misc/R42850.pdf

NOAA NWS. (2015). *Hydrologic Information Center - Flood Loss Data*. Retrieved April 28, 2015, from http://www.nws.noaa.gov/hic/index.shtml

Technical Mapping Advisory Council. (2016, June). *TMAC National Flood Mapping Program Review.* Retrieved from https://www.fema.gov/media-library-data/1474555532007-c063547f6f48026feb68c4bcfc41169d/TMAC_2016_National_Flood_Mapping_Program_Review_Updated.pdf

Wright, J. M. (2007). *The National Flood Insurance Program -- Chapter 10 (AEMRC Training).* Retrieved March 2015, from Floodplain Management: Principals and Current Practices: http://training.fema.gov/HiEdu/docs/fmc/Chapter%2010%20-%20The%20National%20Flood%20Insurance%20Program.pdf

ABBREVIATIONS AND ACRONYMS

ACRONYM	DEFINITION
BFE	Base Flood Elevation
BW-12	Biggert-Waters Flood Insurance Reform Act of 2012
CACs	Community Assistance Contacts
CAP-SSSE	Community Assistance Program – State Support Services Element
CAVs	Community Assistance Visits
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
EIS	Environmental Impact Statement
EMI	Emergency Management Institute
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HFIAA	Homeowner's Flood Insurance Affordability Act of 2014
IPaC	Information, Planning, and Consultation System
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision Based on Fill
NEPA	National Environmental Policy Act of 1969
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NPEIS	Nationwide Programmatic Environmental Impact Statement
OIRA	Office of Information and Regulatory Affairs
OMB	Office of Management and Budget
P. Law	Public Law
SFHA	Special Flood Hazard Area
TMAC	Technical Mapping Advisory Council
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service

Page Intentionally Left Blank.

2 DETAILED DESCRIPTION OF ALTERNATIVES

2.1 INTRODUCTION

The National Environmental Policy Act of 1969 (NEPA) requires that any agency proposing a major Federal action (as defined at 40 Code of Federal Regulations [C.F.R.] § 1508.18) must consider a range of reasonable alternatives. Evaluation of alternatives broadens the scope of reasonable approaches to achieving the stated purpose and helps an agency avoid unnecessary impacts by analyzing reasonable options for achieving the purpose of, and need for, the action. To warrant detailed evaluation, an alternative must be reasonable. Alternatives concerning future program modifications to the National Flood Insurance Program (NFIP) must meet essential technical and economic requirements, comply with governing standards and regulations, and meet the Federal Emergency Management Agency's (FEMA) purpose and need (see Section 1.2). Identifying and analyzing alternatives is an essential part of the NEPA decision-making process. As part of the alternatives analysis, preliminary alternatives are identified. These alternatives are then screened against the project purpose and need, and other criteria. Some alternatives are eliminated from further consideration, and the remaining alternatives are carried forward for additional study.

2.2 DESCRIPTION OF THE ACTION AREA

The Action Area for this Nationwide Programmatic Environmental Impact Statement (NPEIS) is the limit of the jurisdictional boundaries of the NFIP participating communities, including those areas in the United States and its territories designated as Special Flood Hazard Areas (SFHAs) on a Flood Insurance Rate Map (FIRM) under the NFIP. The FEMA-mapped SFHA is the area where the NFIP's floodplain management regulations must be enforced in participating communities (FEMA, 2011). The SFHA is defined as "the land within the floodplain subject to a 1 percent or greater chance of flooding in any given year," often referred to as the 100-year floodplain (44 C.F.R. § 59.1).

2.3 PROGRAM CHANGES TO THE NFIP (PROPOSED ALTERNATIVE)

Potential program changes to the NFIP are included in all or some of the alternatives laid out in Section 2.4 (other than the No Action Alternative). Some of these potential changes are the result of recent legislation amending the NFIA. Other potential program changes were developed to comply, or demonstrate compliance, with the requirements of Section 7 of the Endangered Species Act (ESA), discussed in Section 3.7.2.2. Section 2.3 describes these potential program change elements of the Alternatives in detail. These potential program changes are then referenced, in summary format, in Section 2.4.

2.3.1 Elements of the Alternatives Resulting from Recent Legislation

On July 6, 2012, Congress passed Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12) requiring FEMA to make a number of changes to the administration of the NFIP. Key provisions of the legislation include the requirement to phase out subsidies for certain pre-FIRM properties, the establishment of a Reserve Fund, and the creation of the Technical Mapping Advisory Council (TMAC) to develop recommendations for FEMA's flood mapping program (Public Law [P. Law] 112-141). Some elements of the program changes discussed in the Alternatives—specifically the premium rate increases and the monthly installment plans—are included because they are legislatively required by BW-12 and Homeowner's Flood Insurance Affordability Act of 2014 (HFIAA).

Key provisions of the BW-12 legislation require phasing out subsidies for certain pre-FIRM properties. The pre-FIRM properties for which subsidies will be phased out include non-primary residences, business properties, severe repetitive loss properties, substantially damaged properties, substantially improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property. As of 2013, FEMA began phasing in full risk rates for pre-FIRM non-primary residences, severe repetitive loss properties (1–4 family residences), and properties where the cumulative claims payments exceed the fair market value of the property. BW-12 mandates that the premium rates on these properties be increased by 25 percent each year until full risk rates are achieved.

Additionally, BW-12 requires FEMA to establish an option for non-escrowed policyholders (i.e., for the most part, policyholders not subject to the mandatory purchase requirements) to pay flood insurance premiums through an installment plan.[1]

On March 21, 2014, President Obama signed into law the HFIAA removing some of the provisions, not included in the above discussion on BW-12, and requiring the phase out of subsidies on pre-FIRM properties. However, HFIAA also required a phase out of subsidies on all pre-FIRM properties (not otherwise addressed by the BW-12 premium rate increase provisions) at a rate of no less than 5 percent, and no more than 15 percent, premium rate increases per year, with no individual policy exceeding an 18 percent premium rate increase. FEMA has already begun phasing out these subsidies,[2] and it is expected that the subsidies on pre-FIRM properties will likely be phased out within the next 10 to 20 years. (P. Law 113-89)

2.3.2 Elements of the Proposed Alternative Designed to Comply with Section 7(a)(1) of the Endangered Species Act (ESA)

2.3.2.1 FEMA's Responsibilities under Section 7(a)(1) of the ESA

Some elements of the proposed alternatives‒specifically, the Proposed ESA Regulatory Changes and the ESA Guidance‒were developed by FEMA in compliance with the ESA Section 7(a)(1) requirement to utilize its authorities to further the purposes of the ESA through program changes to conserve listed species and designated critical habitat. In identifying these changes to the NFIP, FEMA looked to the limitations of its current legal authorities and jurisdiction as guideposts for determining what is possible within these narrow constraints. As stated above, the power to regulate development in the floodplain, including approving and denying permits, inspecting property, and citing violations requires land use

[1] This provision was amended by Section 11 of HFIAA to require implementation of a "monthly" installment plan payment option.
[2] While typically an action that has already been implemented would not be appropriate for inclusion in a NPEIS, FEMA chose to include such actions because (a) the implementation of the subsidy phase out will be a 10 to 20 year process, so this action will not be completely implemented for many years to come; and (b) FEMA may need to update its regulations to reflect the new rules for establishing premium rates.

authority. The regulation of land use falls under the State's police powers, which the Constitution reserves to the States, and the States delegate down to their respective political subdivisions. FEMA's role under the NFIP is limited to enrolling communities in the NFIP; setting the minimum floodplain management criteria; providing programmatic monitoring and oversight, and providing technical assistance to ensure that communities are complying with the NFIP program requirements and enforcing program requirements when there are issues of programmatic non-compliance by a participating community. FEMA cannot, either directly through the mechanism of the NFIP or indirectly through the NFIP-participating communities, impose restrictions or prohibitions on the types of floodplain development that are allowed in the floodplain, the amount of development that is allowed in the floodplain, the uses of land that are allowed in the floodplain, or any other general land use restriction that is under State or local land use authority. FEMA determined that the area of discretionary authority in which it could have a significant positive impact, in terms of furthering the purposes of the ESA, is by establishing the minimum floodplain management criteria.

Before discussing the details of the proposed changes, it is important to note at the outset that although these proposed program modifications would include modifications or clarifications to the minimum floodplain management criteria applicable to all NFIP participating communities in furtherance of FEMA's responsibilities under Section 7(a)(1) of the ESA, this does not constitute a shift of FEMA's Section 7 responsibilities onto the communities. As stated above, FEMA is required under ESA Section 7(a)(1) to utilize its authorities in furtherance of the purposes of the ESA through program changes to conserve listed species and designated critical habitat. Any changes FEMA makes to the NFIP in compliance with this requirement will necessarily involve changes for the communities participating in the NFIP and implementing the program requirements. Communities participating in the NFIP are required to implement and enforce the minimum floodplain management criteria. If FEMA makes changes to those criteria in compliance with its responsibilities under Section 7(a)(1) of the ESA, participating communities are required to implement and enforce those criteria as revised. As explained throughout this document, there are limitations on what FEMA may lawfully prescribe as part of the minimum floodplain management criteria, but FEMA does have sufficient legal authority to include an ESA-related performance standard in the criteria.

It is also important to note that FEMA does not intend, through these program changes, to supplant the ESA. While the program modifications proposed in this section would support ESA compliance and further the conservation goals of the ESA, compliance with the new program requirements does not obviate the need for private floodplain development to comply with the ESA.

2.3.2.2 Description of Proposed Program Modifications

In determining what program changes could be made to the minimum floodplain management criteria, FEMA used the existing program structure and legal authorities of the NFIP. Because FEMA has no land use authority, and no ability under the constitution or the NFIA to establish prescriptive land use regulations, the floodplain management criteria are essentially performance standards. FEMA cannot require the communities to prohibit development in the SFHA; it can only place certain flood risk reduction-related conditions on how that development should be carried out to reduce the risk of flood.

Accordingly, as with all other minimum floodplain management criteria, any new criteria would have to be structured as mandatory performance standards. These new criteria would be implemented, monitored, and enforced in the same manner as the other performance standards in the NFIP floodplain management criteria. This includes the development and implementation of guidance to instruct communities as to how the performance standard can or should be met.

Thus, FEMA developed a draft rule that would include a revision to the minimum floodplain management criteria at 44 C.F.R. § 60.3(a)(2) to include an ESA-related performance standard. This standard requires participating communities to assess and mitigate the adverse impacts of development taking place in the SFHAs of participating communities on ESA species and designated critical habitat, including the natural and beneficial functions of floodplains that support such species and habitat. FEMA hoped to be able to incorporate this standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. However, because U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), collectively referred to as the Services, have already non-concurred on this draft rule, FEMA developed an alternative approach that would utilize existing regulatory authority—specifically the requirement in 44 C.F.R. § 60.3(a)(2) that the community must ensure compliance with applicable Federal and State laws as a condition of any floodplain development permit—to achieve the same end. This requirement would be implemented through policy changes and clarifying guidance. Regardless of which of these approaches is used—either the Proposed ESA Regulatory Changes or the "ESA Guidance"—FEMA would implement a requirement on participating communities to document and ensure that any adverse impacts to ESA-listed species and designated critical habitat that may occur as a result of their permitted development in the SFHA have been assessed and appropriately addressed.[3] The specific details of these program modifications are discussed below.

Under Alternatives 3 and 4 below, FEMA would utilize new (Alternative 3/Proposed ESA Regulatory Changes) or existing (Alternative 4/ESA Guidance) performance standards to require NFIP-participating communities, through the community's floodplain development permitting process, to ensure and document that any adverse impacts (direct, indirect, cumulative) caused by the proposed floodplain development to ESA-listed species and their habitat will be assessed and appropriately addressed. These two approaches are laid out in detail below.

a) New ESA-Related Performance Standard Approach (Alternative 3/Proposed ESA Regulatory Changes) – Under this approach, FEMA would establish a new performance standard requiring communities obtain and maintain documentation that any adverse impacts caused by proposed development in the SFHA to ESA-listed species and designated critical habitat, including the natural and beneficial functions of floodplains that support such species and habitat, will be mitigated to the maximum extent possible. Under this approach, the participating communities' responsibilities would include:

   – Obtaining and maintaining documentation that for all floodplain development in the community, the potential for impacts to ESA-listed species and designated critical habitat, and the natural and

[3] Project proponents, developers, and/or communities are required by the ESA to conduct Section 9 consultation with the Services, and to obtain Section 10 permits as necessary. This is an existing requirement under the ESA.

beneficial functions of floodplains that support such species and habitat, have been assessed and any potential adverse impacts have been identified and assessed.

- If potential adverse impacts to ESA-listed species and designated critical habitat, and the natural and beneficial functions of floodplains that support such species and habitat, were identified, communities would be required to obtain and maintain documentation that these impacts will be mitigated to the maximum extent possible.

- Ensuring that required mitigation is undertaken in the following order (unless the Services approve a different order of mitigation): Avoidance, Minimization, and Restoration or Appropriate Compensation.

- Obtaining and maintaining documentation that either (a) the Services (whichever branch, or both, has jurisdiction over the relevant species) have been given an opportunity to review the proposed project or (b) the Services have waived that opportunity to review in writing. Specifically, the community must provide the Services an opportunity to review projects with the potential to adversely impact ESA-listed species and designated critical habitat and provide recommendations for mitigating any adverse impacts. The Services may issue a written waiver of this review opportunity for any proposed project, group of projects, project types, etc. The Services could also waive their opportunity to review for groups of projects meeting certain conditions (e.g., conservation recommendations).

- In this alternative, communities can satisfy the mitigation requirements of this performance standard through a Section 10 incidental take permit, or a Section 7 Incidental Take Statement obtained through another Federal agency, or any other Services-approved mitigation measures.

As with all other minimum floodplain management criteria, the new performance standard would be mandatory, but the community and/or project proponent would determine how to meet the performance standard. When FEMA rolls out new floodplain management criteria, it typically does so through the issuance of a floodplain management guidance and/or technical bulletin. For this proposed change, FEMA would, alone or in coordination with the Services, develop guidance to communicate the steps communities and project proponents should take to assess and mitigate potential adverse impacts on ESA-listed species and designated critical habitat and how to document these activities. The Guidance would explain the new ESA-related performance standard and the steps required for compliance. If needed, FEMA may issue a Technical Bulletin that explains the more technical aspects of compliance with the new policy and/or guidance.

As with existing floodplain management criteria, FEMA will continue to offer technical assistance and training, upon request, through existing and expanded programmatic touch points (e.g., Community Assistance Contacts [CACs] and Community Assistance Visits [CAVs] [see Section 1.3.1.5], technical assistance requests [see Section 1.3.1.4], webinars, meetings with the public and/or the community as part of the Risk MAP process [see Section 1.3.2.3], etc.). FEMA will also provide State-led technical assistance and outreach through the Community Assistance

Program – State Support Services Element (CAP-SSSE) Cooperative Agreements with States and territories. Additionally, FEMA will sponsor training sessions at the Emergency Management Institute (EMI) and/or field deployed courses (see Section 1.3.1.4). FEMA expects to provide a comprehensive and robust technical assistance and outreach campaign related to the proposed modifications to the mapping and floodplain management aspects of the program. This outreach would be directed to all NFIP stakeholders, but particularly States and participating communities, and would include Best Management Practices, guidance, tools, Model Ordinances, compliance checklists, etc.

FEMA would monitor and enforce the new performance standard using existing processes (i.e., CAVs and CACs). The guidance discussed above would provide options for complying with standard. A participating community's adherence to specific guidance in issuing floodplain development permits would ensure compliance with the new ESA-related performance standard in the floodplain management criteria. If the guidance was not adhered to with respect to a floodplain development permit or permits, the community must demonstrate that compliance with the new performance standard in the floodplain management criteria was still achieved despite non-adherence with the guidance.

In lieu of documentation demonstrating compliance with the proposed guidance, communities and/or project proponents may also submit documentation of compliance with Services' recommendations issued pursuant to a consultation involving another Federal agency under Section 7 of the ESA, a habitat conservation plan developed under Section 10 of the ESA, coordination required by the new performance standard, or any other process deemed acceptable to FEMA and the Services.

b) Existing Performance Standard Approach – Under this approach, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to obtain and maintain documentation that private floodplain development was undertaken in compliance with the ESA. Under this approach, the participating communities' have the following responsibilities:

- Obtaining and maintaining documentation, with respect to any proposed development in the SFHA, indicating whether any ESA-listed species and designated critical habitat are located in the project area and, if so, the potential impacts of the proposed development on those ESA-listed species and designated critical habitat.

- If potential adverse impacts to ESA-listed species and designated critical habitat were identified, the community would be required to obtain and maintain documentation that the community and/or project proponent coordinated with the Services (either branch, or both, as appropriate).

- If it is determined, after coordination with the appropriate branch(es) of the Services, that the identified adverse impact could effect a "take" of ESA species, the community would be required to obtain and maintain documentation that, with respect to the proposed development, an

Incidental Take Permit has been obtained pursuant to ESA Section 10 or a Section 7 consultation has been completed by another Federal agency.

As with other guidance clarifying the requirements of the minimum floodplain management criteria, the ESA Guidance would indicate what communities and/or project proponents must do to comply with the performance standard and also offer options for how to comply. When FEMA rolls out floodplain management program clarifications, it typically does so through the issuance of a floodplain management guidance and/or a technical bulletin. FEMA would seek to work with the Services to develop guidance to communicate the steps communities and project proponents should take to assess potential adverse impacts on ESA species and critical habitat, and how to document these activities. The Guidance would explain the new requirements and the steps required for compliance. Because the Services have already developed guidance on mitigating adverse impacts as part of the development of a Habitat Conservation Plan pursuant to Section 10 of the ESA, FEMA would not develop any guidance on mitigation of impacts under the Existing Performance Standard Approach unless the Services identified a need for such guidance. In that case, FEMA would, in coordination with the Services, undertake the development of such guidance as a further Section 7(a)(1) measure to benefit the species. If needed, FEMA may also issue a Technical Bulletin that explains the more technical aspects of compliance with the performance standard and/or guidance.

As with existing floodplain management criteria, FEMA will continue to offer technical assistance and training, upon request, through existing and expanded programmatic touch points (e.g., CACs and CAVs [see Section 1.3.1.5], technical assistance requests, CRS reviews, webinars, meetings with the public and/or the community as part of the Risk MAP process [see Section 1.3.2.3], etc.). FEMA will also provide State-led technical assistance and outreach through the CAP-SSSE Cooperative Agreements with States and territories. Additionally, FEMA will sponsor training sessions at the EMI and/or field deployed courses (see Section 1.3.1.4). FEMA expects to provide a comprehensive and robust technical assistance and outreach campaign related to the proposed modifications to the mapping and floodplain management aspects of the program. This outreach would be directed to all NFIP stakeholders, but particularly states and participating communities, and would include Best Management Practices, guidance, tools, Model Ordinances, compliance checklists, etc.

As with the ESA-related performance standard to be implemented through changes to the regulatory floodplain management criteria, FEMA would monitor and enforce the ESA Guidance using current processes (i.e., CAVs and CACs). Community permits will be reviewed to ensure that, for all proposed development in the SFHA, communities are requiring documentation that the effects on species have been assessed and addressed. This can include documentation of compliance with Services' recommendations issued pursuant to a consultation involving another Federal agency under Section 7 of the ESA, a habitat conservation plan developed under Section 10 of the ESA, or any other process deemed acceptable to FEMA and the Services.

Under either approach, FEMA would develop guidelines and/or a process for documenting community compliance with the ESA-related requirements. FEMA's responsibility would be to ensure a community's programmatic compliance with the ESA-related requirements as part of FEMA's monitoring and enforcement of the minimum floodplain management criteria.

The Proposed ESA Regulatory Changes included as part of Alternative 3 would also include additional modifications to the floodplain management criteria, including: (a) clarification in 44 C.F.R. § 60.3(d)(4) that the current exception to the no-rise performance standard in the floodway applies only to projects that serve a public purpose or result in the restoration of the natural and beneficial functions of floodplains; and (b) an increase in the probation surcharge applicable to NFIP communities placed on probation from $50 to $100.

a) Public Purpose Floodway

In accordance with FEMA's current regulations, communities that have established a regulatory floodway may not permit encroachments in the adopted regulatory floodway if that encroachment would result in any increase in the Base Flood Elevation (BFE) (44 C.F.R. § 60.3(d)(3)). In 44 C.F.R. § 60.3(d)(4), however, there is a process whereby communities can allow for exceptions to this limitation on BFE increases contained in 44 C.F.R. § 60.3(d)(3). To this end, in 44 C.F.R. § 60.3(d)(4), where a regulatory floodway is established, a community is permitted to allow encroachments within the adopted regulatory floodway that would result in an increase in the BFE if the community: (1) applies for a conditional FIRM and floodway revision, (2) fulfills the requirements for such revisions as established under the provisions of 44 C.F.R. § 65.12, and (3) receives the approval of the Federal Insurance Administrator.

In 44 C.F.R. § 65.12, the community is required to apply to FEMA for conditional approval of the map change associated with such action prior to permitting the encroachment to occur. In addition, the community must submit, as part of its application, various documents as evidence that a BFE increase is justified, that all engineering alternatives were considered and determined to be unsuitable, that community approval has been obtained, that no structures are impacted, and that any property owners adversely impacted have been properly notified.

Under this program modification, FEMA would revise 44 C.F.R. § 60.3(d)(4) to clarify that a community may permit encroachments within the regulatory floodway that would result in an increase in the BFE, provided that the encroachment is a public purpose development. As part of this revision, FEMA would define "public purpose development" in 44 C.F.R. § 59.1 to clarify the type of encroachment that may be permitted in the regulatory floodway. "Public purpose development" would be defined to mean: (1) Flood protection system that cannot perform its intended purpose unless it is located or carried out in the floodway (such as dams, reservoirs, detention basins, levees, and dikes); (2) Infrastructure that cannot perform its intended purpose unless it is located or carried out in the floodway and is required to support existing structures and other public purpose development (such as facilities or right-of-way necessary to provide transportation, bridges, docking facilities, port facilities, drainage systems, and utilities); (3) Floodplain restoration projects that are designed primarily to restore the natural and beneficial functions of the floodplain (such as habitat restoration projects, dam removal, riparian planting, reconnecting floodplains, restoration of flood areas, and levee setback or removal); and (4) Open space areas (such as parks, trails, paths, playgrounds, and other uses that are compatible with the preservation of open space).

b) Increase in Probation Surcharge

When a community fails to enforce the NFIP floodplain management requirements and FEMA identifies one or more substantive program deficiencies or violations, FEMA may initiate an enforcement action against the community to obtain compliance. When community assistance fails to resolve a community's compliance problems, the NFIP may place the community on probation. In accordance with FEMA's current regulations, when a community is placed on probation, FEMA must place a notice in the *Federal Register* and add a $50 surcharge to the flood insurance policies of all policyholders in that community (44 C.F.R. §§ 59.24(b)-(c) and § 61.16). Under this program modification, FEMA would modify 44 C.F.R. § 59.24 and § 61.16 to increase the probation surcharge from $50 to $100.

In 1985, FEMA first proposed the probation surcharge to encourage communities that were non-compliant with the floodplain management requirements to remedy the deficiencies without having to be suspended from the program. Property owners in communities placed on probation are still allowed to obtain flood insurance coverage for their property. The surcharge is not intended to be punitive, but rather to focus the attention of policyholders on the community's non-compliance so the policyholders might encourage the community to come into compliance and avoid the adverse impacts to policyholders associated with a suspension from the NFIP. The surcharge was also intended, in part, to compensate the NFIP for a portion of the increased liability that results from the community's non-compliance with the minimum floodplain management criteria.
FEMA is proposing an increase in the probation surcharge to $100 because the surcharge has not been adjusted since 1992 and does not account for inflation. As a result, FEMA is proposing to adjust the probation surcharge to $100 so that the regulation will continue to have value as an enforcement tool by focusing the attention of policyholders on the community's non-compliance and will encourage the community to come into compliance to avoid the adverse impacts that suspension from the NFIP would have on these policyholders.

2.3.3 Elements of the Proposed Alternative Designed to Demonstrate Compliance with the Endangered Species Act

FEMA does not fund, authorize, or carry out private floodplain development through the NFIP. Similarly, the NFIP does not cause private floodplain development to occur. As discussed in Appendix C, NFIP Biological Evaluation, available research and studies suggest that the NFIP is not a determining factor in the decision of whether or not to develop in the floodplain. Nevertheless, some perceive that certain actions taken under the NFIP—specifically the issuance of certain Letters of Map Change (LOMCs), the mapping of a levee system as meeting the requirements for accreditation, and the designation of a levee system in an AR or A99 Zone—encourage some floodplain development.

2.3.3.1 LOMCs

As stated above, some perceive that the issuance of certain LOMCs encourages some development in the floodplain. The specific LOMCs of interest are Letter of Map Revision (LOMR) and Letter of Map Revision Based on Fill (LOMR-F). A LOMR is FEMA's modification to an effective FIRM. LOMRs are generally issued to update hydrologic or hydraulic characteristics of a flooding source that result in the modification of the existing regulatory floodway, the effective BFEs, or the SFHA. While many of these revisions are based on the completion of a physical project that would impact the hydrologic or hydraulic characteristics of a flooding source, not all LOMRs are based on physical projects. Updated technical data, such as topography or alternative models and analyses, may impact the floodway, SFHA, or BFEs without the completion of a physical project.

A LOMR-F is when a property is located or will be located in an SFHA, and property owners or project proponents choose to elevate the grade of the land on their properties through the placement of fill to elevate the grade of the land above the projected 1-percent-annual-chance flood elevation (known as the BFE). This would elevate the land outside the SFHA and, thus, out of the area of flood hazard. This is an effective method of reducing the risk of flood damage to property and protecting against loss of life in the event of a flood. In fact, it is so effective that some States choose to prescribe this as the only method of elevating structures. Once a property is elevated above the SFHA, it is eligible to be identified as outside of the SFHA through the issuance of a LOMR-F.

Once a property is shown or determined to be out of the SFHA, whether through the issuance of a LOMR or LOMR-F, there are other perceived "benefits" to the property owner beyond flood risk reduction. The first benefit is that the property owner is no longer subject to the mandatory purchase requirement of 42 United States Code (U.S.C.) § 4012a, which applies only to structures located in the SFHA. The second benefit is that the property is no longer subject to the minimum floodplain management regulations, which apply only to properties located in the SFHA. However, it is important to note that communities can, and do, regulate floodplain management outside the context of the NFIP, and they also frequently place floodplain management requirements on individuals within the community that go beyond the minimum floodplain management requirements of the NFIP.

Because these benefits extend beyond flood risk reduction, some perceive that the NFIP encourages the placement of fill for the purpose of having the property removed from the SFHA and the requirements related to properties in the SFHA. This floodplain development may, in turn, cause adverse impacts to ESA-listed species and designated critical habitat. Notably, there are no studies that support the causal relationship between FEMA's issuance of LOMR-Fs and increased incidence of the placement of fill—other than one study based on the perceptions of a very small study sample of survey respondents about others' reasons for developing in certain areas. (American Institutes for Research - Rosenbaum, W. and Boulware, G., 2006)

2.3.3.2 Mapping a Levee System as Accredited

As discussed above, FEMA does not certify, design, construct, permit, or otherwise approve levees, levee systems, or floodwalls. However, FEMA has regulatory requirements (44 C.F.R. § 65.10) that must be met before any levee, levee system, or floodwall can be depicted on a FIRM as reducing the risk of the 1-

percent-annual-chance flood, also referred to as the base flood. While there are no immediate consequences to the determination that a levee system meets levee accreditation requirements described in 44 C.F.R. § 65.10, generally the community will request that FEMA issue a LOMR to revise the flood hazards shown on the effective FIRM, as appropriate, to identify the area landward of the levee as outside the SFHA. In addition to the reduction of flood risk to these properties provided by the levee system, the property owners would incur the same perceived benefits associated with removal of the SFHA designation described above (e.g., removal from mandatory purchase requirement and applicability of FEMA's minimum floodplain management requirements).

2.3.3.3 AR/A99 Zone Determinations

As discussed above, participating communities, as well as Federal and State agencies, may restore the risk reduction capability of existing levee systems to reduce flood risks in a particular community or particular area of a State. Zone AR is a flood insurance risk zone designation given to previously accredited levee systems that have been decertified, but are determined to be in the process of being restored to provide risk reduction to the 1-percent-annual-chance or greater flood (42 U.S.C. § 4014(f)). If the community meets the requirements of 44 C.F.R. § 65.14 and FEMA makes a "flood protection restoration" determination, FEMA is statutorily required to change the zone designation of the levee-impacted areas to Zone AR by updating the FIRM panels, typically by issuing a LOMR, and apply the flood insurance premium rates applicable to Zone AR.

Likewise, Federal and State agencies, and communities may design and build new levee systems, or they may restore the flood risk reduction capability of existing levee systems, to reduce flood risks in a particular community or particular area of a State. Zone A99 is a flood insurance risk zone designation that may be used by FEMA in areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately have this risk reduced upon completion of an under-construction levee system. If the community meets the criteria established in 44 C.F.R. § 60.3(f) and FEMA makes an adequate progress determination, FEMA is statutorily required to change the zone designation to Zone A99 for the levee-impacted area by updating the FIRM panels, typically by issuing a LOMR, and apply the flood insurance premium rates that would be applicable when the project is completed (42 U.S.C. §4014(e)).

However, although an AR or A99 zone determination could result in lower flood insurance rates, the mandatory flood insurance purchase requirement is still in effect for areas receiving these zone designation changes, and the floodplain management criteria still apply to these areas.

2.3.3.4 Description of Proposed Changes

The issuance of LOMRs and LOMR-Fs is a non-discretionary action for which FEMA has no obligation to consult. Nevertheless, to the extent that the issuance of certain LOMCs are perceived to offer some encouragement to develop in the floodplain, FEMA proposes to take measures within its discretion to demonstrate that its actions in issuing LOMRs and LOMR-Fs are ESA-compliant. FEMA is not responsible for private floodplain development, or for ensuring that such development is compliant with the ESA. FEMA does require the participating community to provide written assurance of compliance with appropriate sections of 44 C.F.R. § 60.3 prior to processing a LOMR or a LOMR-F request.

Currently, FEMA's minimum floodplain management criteria at 44 C.F.R. § 60.3(a)(2) require communities to, for all floodplain development permits, "review [the] proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law…". FEMA proposes to issue clarification guidance stating that, under this minimum floodplain management criterion, the community must obtain and maintain documentation of compliance with the ESA for the proposed floodplain development. FEMA would require that communities maintain the documentation with the official designated by the community under Section 59.22(a)(9)(iii). Communities will be required to show records to FEMA upon request that document that all proposals for development within the SFHA meet these documentation requirements. These records must be maintained until requested by FEMA or the State NFIP Coordinator.

Furthermore, FEMA would require the community, or the project proponent on the community's behalf, to produce documentation of compliance with the ESA prior to processing LOMR and LOMR-F requests based on physical development in the floodplain. By documenting that the private floodplain development for which a LOMR or LOMR-F is sought is ESA-compliant, FEMA can demonstrate that it is only issuing LOMRs or LOMR-Fs for ESA-compliant floodplain development (and, thus, not encouraging floodplain development that adversely impacts ESA-listed species and designated critical habitat). Notably, the LOMC documentation requirement would also cover LOMCs associated with the mapping of levee accreditations, as well as Zone AR and A99 determinations.

It is important to note that FEMA is not, through these proposed program modifications, expanding the requirements applicable to private floodplain development under the ESA. Project proponents of private floodplain development have always been required to ensure their project does not cause a "take" in violation of Section 9 of the ESA or, in the alternative, to secure a Section 10 incidental take permit authorizing the incidental take of threatened and endangered species.[4] FEMA is merely clarifying that the existing requirement under 44 C.F.R. § 60.3(a)(2)—that NFIP-participating communities ensure that all required Federal permits are obtained as a condition of issuing a permit for development in the floodplain—also includes a documentation requirement so that FEMA can verify that the community is implementing and enforcing this requirement.

Moreover, these proposed program modifications do not constitute an improper shift of FEMA's Section 7 responsibilities under the ESA to the communities or project proponents because the documentation requirements relate to the compliance of private project proponents with sections of the ESA that are applicable to private floodplain development (i.e., Sections 9 and 10 of the ESA). FEMA does not authorize, fund, undertake, or encourage private floodplain development. As such, it has no responsibilities under Section 7 of the ESA with respect to such private development. That being said, the community may choose to take on the responsibility for assessing the impacts of individual land use decisions on listed species, but they do not have to because it is the responsibility of the project proponent, as are other technical aspects of the permitting process.

As with the other performance standards in the NFIP minimum floodplain management criteria, FEMA does not prescribe the format the community must use to document compliance. The community has the

[4] These requirements are discussed in greater detail in Section 3.7.2.2 of this document.

discretion to determine the appropriate review and documentation process that works best for the community, as long as the community obtains and maintains documentation of project proponents' compliance with the requirements of the ESA.

Whether it is the community or the project proponent that assumes the responsibility for documenting compliance with the ESA, one of the following should be documented:

1. No potential for "take" exists (meaning that the project has no potential to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) to threatened and endangered species. The project proponent will be responsible for the determination of whether the project has potential for take. The determination is not required to come from, or be concurred on by, the Services.

OR

2. If the project proponent determines a "take" may or will occur, they can contact the Services to discuss potential changes to the project so there is no potential for "take."

OR

3. If Options 1 or 2 are not possible, and the Services determine that the project may or will result in a "take" of ESA-listed species, an Incidental Take Permit may be submitted showing that the project is covered by the permit.

There are a number of ways to comply with these ESA documentation requirements, some of which are discussed below. One way to demonstrate compliance is to obtain documentation that no ESA-listed species or designated critical habitat are present in the proposed project area. Information on the location of ESA-listed species and habitat is available through endangered species listing notices published in *Federal Register* by the Services and posted on their websites. The Services typically designate ESA-listed species and designated critical habitat at the county level. As a result, the project proponent or community will need to translate this county-specific information to the project level in order to determine if ESA-listed species are present at the site. Designated critical habitat boundaries and descriptions are also published by notices in the *Federal Register*. In some cases, the Services may graphically depict this information on their websites.

In addition to the Services' website, USFWS manages a web-based platform called the Information, Planning, and Consultation System (IPaC). IPaC is available in many States and can assist the user in determining if ESA-listed species or designated critical habitat are in the project area. IPaC provides a simple and expeditious method for a project proponent to determine whether ESA-listed species or designated critical habitat are located in the project area and for project proponents or communities to document this as part of their review process. A project proponent or community may also contact the nearest USFWS or NMFS office to determine if ESA-listed species or designated critical habitat are present. In addition, State fish and wildlife agencies may provide ESA-listed species and designated critical habitat information on their websites.

Another way to document compliance is to obtain documentation that ESA-listed species or designated critical habitat are present, but there will be no "take" as a result of the proposed floodplain development. To provide this documented evidence, the project proponent can complete an assessment to determine if the proposed project could cause a "take" of ESA-listed species or designated critical habitat.[5]

Such an assessment would typically include the following: a description of the project area; a description of any habitat (or floodplain functions) in the project area, including the presence of ESA-listed species or designated critical habitat; a description of the project including the process or methodology used to construct the project; and an assessment of the effects the project will have on the ESA-listed species, designated critical habitat, and floodplain functions previously identified. An assessment does not have to be lengthy and may consist of only a few paragraphs depending on the complexity of the project.

If an assessment is completed and it is determined that the project as proposed could cause a "take," the project proponent or community can document compliance by showing that they obtained an incidental take permit from the Services pursuant to Section 10 of the ESA. The project proponent also has the option of re-designing the project or implementing mitigation measures to avoid causing a "take" and then documenting compliance through a revised assessment (as discussed above). For example, the proposed project could be re-designed to: (1) use low impact development techniques; (2) designate buffer areas that are not disturbed during or after construction; or (3) use environmental-friendly construction best management practices. Environmental-friendly construction best management practices could include: incorporating erosion and sedimentation control measures; using vegetable oil-based hydraulic fluids in all equipment working in water; preparing and training crews on a spill prevention and pollution control plan; storing, staging, and refueling equipment outside the riparian habitat zone; inspecting equipment daily for leaks; using permeable pavement; or requiring project work to occur during "species work windows" when the ESA-listed species are not present or will not be affected.

The Services are the designated authority on ESA compliance to ensure that private development is carried out in compliance with the ESA and that there is no take occurring in violation of Section 9 of the ESA; therefore, any documentation or approvals from the Services, including documentation stating that an incidental take is not required for a proposed project, would serve as the "gold standard" in ESA documentation for specific projects.

As with existing floodplain management criteria, FEMA will continue to offer technical assistance and training, upon request, through existing and expanded programmatic touch points (e.g., CACs and CAVs [see Section 1.3.1.5], technical assistance requests, CRS reviews, webinars, meetings with the public and/or the community as part of the Risk MAP process [see Section 1.3.2.3], etc.). FEMA will also provide State-led technical assistance and outreach through the CAP-SSSE Cooperative Agreements with States and territories. Additionally, FEMA will sponsor training sessions at the EMI and/or field

[5] Section 9 of the ESA prohibits the taking of endangered or threatened species. "Take" is defined to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct (16 U.S.C. § 1532(19)). "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering (50 C.F.R. § 17.3). Therefore, the concept of "take" includes actions that would damage species' habitat.

deployed courses (see Section 1.3.1.4). FEMA expects to provide a comprehensive and robust technical assistance and outreach campaign related to the proposed modifications to the mapping and floodplain management aspects of the program.

In order to assist all communities in their implementation of the proposed program modifications, FEMA would expand the provision of technical assistance, outreach, and training to States, communities, and stakeholders. Section 2.3.2.2 provides more details on the types of technical assistance FEMA will provide to assist communities in implementing the Alternatives.

2.4 ALTERNATIVES

Table 2-1 identifies the Alternatives analyzed in this document. Section 2.4 provides descriptions of the No Action Alternative (Section 2.4.1) and all modifications to the NFIP (Sections 2.4.2 to 2.4.5). A more detailed discussion of the proposed modifications included as part of each alternative may be found in Section 2.3.

Table 2-1: Alternatives

		Alternative 1 (No Action)	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Category		**Section 2.4.1**	**Section 2.4.2**	**Section 2.4.3**	**Section 2.4.4**
No Action	No Action	X			
Legislatively Required Changes	Phase out of subsidies on certain pre-FIRM properties (non-primary, etc.)		X	X	X
	Phase out of subsidies on all other pre-FIRM properties		X	X	X
	Implementation of a monthly installment plan for non-escrowed policies		X	X	X
LOMC Clarification	Clarification of ESA documentation requirements for LOMCs		X	X	X
ESA-related Changes	Proposed ESA Regulatory Changes (New 44 C.F.R. § 60.3 Performance Standard; Probation Surcharge increase; Clarification on the exception to the no-rise performance standard in the floodway)			X	
	Implementation of ESA-related performance standard through guidance				X
	Floodplain Management Criteria Guidance		X		

2.4.1 Alternative 1 (No Action)

The No Action Alternative refers to the current implementation of the NFIP as described in Section 1.3. The No Action Alternative is prescribed by Council on Environmental Quality (CEQ) regulations (40 C.F.R. § 1502.14(d)) and serves as a benchmark against which impacts of the alternatives can be evaluated.

2.4.2 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

The changes included under Alternative 2 are:

a) Phase out of subsidies on certain pre-FIRM properties (non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property) at a rate of 25 percent premium increases per year.
b) Phase out of subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.
c) Implement a monthly installment plan payment option for non-escrowed flood insurance policies.[6]
d) Clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain.
e) Clarify that the issuing of certain LOMC requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA.

2.4.3 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The changes included as part of Alternative 3 are:

a) Phase out of subsidies on certain pre-FIRM properties (non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property) at a rate of 25 percent premium increases per year.
b) Phase out of subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.
c) Implement a monthly installment plan payment option for non-escrowed flood insurance policies.[7]

[6] Although FEMA has not worked out all the details of how this proposed modification would be implemented, use of the installment plan payment option would require the policyholder to pay an installment plan service fee, which is consistent with standard industry practice.
[7] Ibid.

d) Establish a new ESA-related performance standard in the minimum floodplain management criteria at 44 C.F.R. § 60.3 that would require communities to obtain and maintain documentation that any adverse impacts caused by proposed development, including fill, to ESA-listed species and designated critical habitat will be mitigated to the maximum extent possible.
e) Increase the probation surcharge applicable to NFIP communities placed on probation from $50 to $100.
f) Clarify that the exception to the no-rise performance standard in the floodway applies only to projects that serve a public purpose or result in the restoration of the natural and beneficial functions of floodplains.
g) Clarify that the issuance of certain LOMC requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA.

2.4.4 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The changes included under Alternative 4 are:

a) Phase out of subsidies on certain pre-FIRM properties (non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property) at a rate of 25 percent premium increases per year.
b) Phase out of subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.
c) Implement a monthly installment plan payment option for non-escrowed flood insurance policies.[8]
d) Utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that the proposed development in the floodplain will be undertaken in compliance with the ESA.
e) Clarify that the issuance of certain LOMC requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA.

2.4.5 Summary of the Alternatives Considered but Not Carried Forward

Based on consultations, meetings, and public comments involving participants from FEMA, other Federal and State agencies, environmental organizations, and the public, FEMA considered other potential modifications to the program. However, after preliminary evaluations, these alternatives were not found to be reasonable. The modifications considered are discussed in more detail below.

[8] Ibid.

- 2012 Notice of Intent (NOI): In the 2012 NOI (77 *Federal Register* 28891-28893), FEMA proposed to evaluate the following alternatives that are not carried forward:

  – Discontinue the NFIP. This alternative was dismissed from further consideration because it is an alternative that can only be implemented through legislative action. With the reauthorization of the NFIP in 2012, Congress made it clear that it was their intent to continue the NFIP.

  – Request legislative authority to remove existing cross subsidies for flood insurance policies. This alternative was dismissed from further consideration because it is an alternative that can only be implemented through legislative action. With the implementation of HFIAA in 2014, Congress made it clear that it was their intent to continue the existing cross-subsidies within the NFIP. Section 100207 of BW-12 includes a provision that would have phased out the cross-subsidies within the NFIP by eliminating a process known as grandfathering.

    When flood map changes occur, the NFIP provides a lower-cost flood insurance rating option known as "grandfathering." It is available for property owners who: (a) already have flood insurance policies in effect when the new flood maps become effective and then maintain continuous coverage; or (b) have built in compliance with the FIRM in effect at the time of construction. However, to offer lower flood insurance rates to these property owners, FEMA must increase the rates on all other property owners within the class (i.e., those property owners who have built in compliance with the current FIRM).

    Section 100207 of BW-12 would have ended this practice, but due to the strong pushback against the resulting premium increases that certain policyholders would have incurred had this provision been implemented, Congress repealed this provision in Section 4 of HFIAA. Because legislative action is required to implement this alternative and Congress has already made its will clear in this matter, FEMA chose not to further analyze this alternative.

- Changes to the LOMR-F Process: Once a property is shown or determined to be out of the SFHA, whether through the issuance of a LOMR-F, there are certain perceived "benefits" to the property owner beyond flood risk reduction. The first benefit is that the property owner is no longer subject to the mandatory purchase requirement of 42 U.S.C. § 4012(a), which applies only to structures located in the SFHA. The second benefit is that the property is no longer subject to the minimum floodplain management regulations, which apply only to properties located in the SFHA.

  Under this alternative, FEMA would still allow property owners to seek LOMR-Fs, and FEMA would update flood maps to accurately reflect the flood risk. However, FEMA would disassociate the process of updating the flood maps to reflect the updated risk information with the associated perceived benefits—removal from application of the floodplain management requirements and elimination of the mandatory purchase requirement. For all practical purposes, these properties would be considered by the NFIP as remaining in the floodplain. In short, while the flood maps would be updated in the same manner as they are updated under the current LOMR-F process, these properties would still be considered to be in the floodplain and, as such, subject to the floodplain management requirements and the mandatory purchase requirement.

FEMA dismissed this alternative for a number of reasons. First, addressing the potential impacts of floodplain development on ESA-listed species and designated critical habitat at the LOMR-F stage—after the floodplain development has already taken place—is neither efficient, nor effective. The most effective time to address such impacts is at the floodplain development permitting stage, which takes place prior to occurrence of such development, because this is the stage in which the community or project proponent is best positioned to take action to avoid or mitigate such impacts. In contrast, LOMR-Fs are issued for floodplain development that has already taken place, so communities and project proponents will be very limited in their ability to mitigate any impacts to ESA-listed species and designated critical habitat that have already taken place.

Second, FEMA dismissed this alternative because use of such a mechanism would appear to penalize property owners that had taken action to reduce their flood risk by subjecting them to the same regulatory requirements that apply to those property owners who have done nothing to reduce their flood risk. This perceived penalty may, in turn, discourage property owners from undertaking measures to reduce their flood risk, which would conflict with a key purpose of the NFIP.

Third, there are practical hurdles to implementing this alternative. One important one is that there are a number of States that require placement of fill as the only means of elevating structures in the floodplain. If this alternative were implemented, all of these States would be required to change their laws, which would be a very time-consuming and difficult process. Additionally, there are internal hurdles to implementation, such as including required rulemaking, the possible need to establish a new flood zone to reflect properties that remain in the floodplain despite their reduced flood risk, or how these changes would apply to fill placement that pre-dated implementation of the alternative. There are also uncertainties as to whether FEMA has the legal authority to undertake these changes.

- <u>Revise the 1-percent-annual-chance flood event to another standard, such as the 0.2-percent-annual-chance flood event, to expand the applicability of the floodplain management criteria to more areas:</u> Such a change would be made in furtherance of FEMA's responsibility under Section 7(a)(1) of the ESA to make program changes within its legal authorities to carry out a conservation program for threatened and endangered species. However, this assumes that such a change would in fact promote the conservation of threatened and endangered species. Certain groups in turn, base this assumption on a perception that if FEMA were to expand its regulatory jurisdiction into more areas, thereby expanding the application of the minimum floodplain management criteria to those areas, ESA-listed species and their habitat would indirectly benefit. In fact, there is no conclusive evidence to suggest that they would. On December 3, 2014, FEMA requested that the Services provide FEMA with their maps showing where threatened and endangered species are located, which FEMA could then use to determine where—within, and just outside, the SFHA—ESA-listed species and designated critical habitat are located. To date, FEMA has received no response, although the Services have verbally indicated that they do have such maps and information for the vast majority of species. Without these maps and information, FEMA has no evidence to show that this proposed change would have any appreciable effect on ESA-listed species or designated critical habitat because FEMA has no evidence to show that the expanded floodplain would include a significant number of areas in which such species are located. Indeed, in many communities, the 100-year floodplain and the 500-year floodplain are coextensive, meaning that there would be no actual expansion of the floodplain to include any new areas. Additionally, FEMA has determined in its Biological Evaluation (BE) that while the application of the minimum floodplain management criteria has been shown to result in flood risk reduction, there are insufficient data and studies to show that application of such criteria will benefit ESA-listed species and their habitat. As such, there are insufficient data, studies, and information to support the benefits to ESA-listed species and critical habitat, while it is certain that there would be substantial practical impacts of such a program change on the NFIP participating communities, as well as the Federal, State, and local communities that have adopted the 1-percent-annual-chance flood event as their standard based on FEMA's use of that standard.

- Incorporating Climate Change in Flood Maps: FEMA considered modifications related to climate change in the development of the NPEIS; specifically, FEMA is considering recommendations received from the TMAC on this subject. As directed by Congress, the TMAC is tasked with developing recommendations for FEMA's flood hazard mapping program to ensure that FIRMs reflect the best available science and methodologies for considering the impact of future development on flood risk. FEMA received the TMAC 2015 Future Conditions Risk Assessment and Modeling report on February 8, 2016 (Appendix K) (Technical Mapping Advisory Council, 2015).

  In that report, the TMAC summarized the current status of the NFIP with respect to mapping future conditions flood hazards in Chapter 2: "The NFIP generally does not consider future conditions hydrology or hydraulics for the identification of SFHAs, where the minimum development standards of the program apply. Current mapping practice is to apply historical climate information to existing topography and development conditions. Minor adjustments can be made to the application of historical data, but current FIRMs do not predict or project future flood hazards based on future climate and sea level" (Technical Mapping Advisory Council, 2015, pp. 2-6 and 2-7). The TMAC also noted the exception to FEMA's general practice of not considering future conditions hydrology (Technical Mapping Advisory Council, 2015, pp. 2-11). Under 44 C.F.R. § 64.3(a), FEMA will incorporate future conditions hydrology resulting from land use development at the request of a participating community. This future conditions information is provided for informational purposes only and carries with it no additional regulatory requirements or insurance rating implications. When presenting the TMAC 2015 Future Conditions Risk Assessment and Modeling report, the TMAC clearly stated its intention that, similar to the current program, all future conditions information developed by FEMA should be non-regulatory in nature and that communities should be given the discretion to adopt them as regulatory if they so choose (Technical Mapping Advisory Council, 2015, pp. 5-16).

  In the TMAC 2015 Future Conditions Risk Assessment and Modeling report, the TMAC offered a variety of recommendations related to the mapping of future conditions flood hazards, including climate change in coastal areas, erosion zones, and future conditions land use (Technical Mapping Advisory Council, 2015, pp. 4-26). FEMA intends to implement the TMAC recommendations contained in the TMAC's Future Conditions Risk Assessment and Modeling report, and FEMA has provided its responses and proposed implementation steps in its report to Congress responding to the TMAC's 2015 recommendations (Appendix L) (FEMA, 2017). However, as demonstrated by this report, these changes are not ripe for NEPA analysis at this time. "'[P]rojects' for the purposes of

NEPA, are described as 'proposed actions,' or proposals in which action is imminent" (O'Reilly v. U.S. Army Corps of Engineers, 2007). "The mere contemplation of certain action is not sufficient..." (O'Reilly v. U.S. Army Corps of Engineers, 2007). FEMA is still at the very early stages of determining the implementation steps necessary to incorporate the TMAC's recommendations in FEMA's Flood Hazard Mapping Program. Thus, implementation of the TMAC recommendations, including recommendations concerning mapping climate change, is not yet ripe for inclusion as an alternative that warrants analysis of environmental impact.

Additionally, it is necessary for FEMA to ensure that it is not duplicating efforts already underway by other Federal agencies. Moreover, FEMA understands that where possible, its efforts should complement and enhance existing initiatives from other Federal investments in the state of the science and its application to flood risk management.

2.5 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

CEQ's implementing regulations (40 C.F.R. § 1502.14(c)) instruct Environmental Impact Statement (EIS) preparers to "Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference." At this point in the process, FEMA's preferred alternative is Alternative 2 to implement the legislatively required changes, floodplain management criteria guidance, and mapping modifications (as described in Section 2.4.1). Implementation of this alternative would meet FEMA's purpose and need as described in Section 1.2. In addition, Alternative 2 causes the least environmental impact overall. Alternative 2 is the only alternative within FEMA's discretion that meets the required timeframe.

Alternatives 3 and 4 would meet the purpose and need, but after an extensive coordination effort with the Services, FEMA has been unable to secure the Services' concurrence on either alternative. Before FEMA can publish a proposed or final rule, it is reviewed by other parts of the Federal government. By executive order, the Office of Management and Budget’s (OMB) Office of Information and Regulatory Affairs (OIRA) reviews draft proposed and final rules from executive agencies to ensure that regulations are consistent with applicable law and the President’s priorities, and that decisions made by one Agency do not conflict with the policies or actions taken or planned by another. If proposed or final rules are deemed "significant" pursuant to EO 12866, OIRA must review them and coordinate review with other Federal agencies that have an interest in the issue. A "significant regulatory action" means any regulatory action that is likely to result in a rule that may: (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this EO.

The interagency review of draft proposed and final regulatory actions is intended to ensure that actions are coordinated with other agencies to avoid inconsistent, incompatible, or duplicative policies. A draft rule must obtain the appropriate clearances before it can proceed to publication, and OIRA may return for further consideration draft rules that are not consistent with other Executive Branch agency regulations or efforts. Under EO 12866, disagreements or conflicts between or among agency heads or between OMB and any Agency that cannot be resolved by the Administrator of OIRA must be resolved by the President, or by the Vice President acting at the request of the President.

The USFWS and the NMFS are the agencies charged with consulting on Federal agency actions, including proposed program changes and regulatory amendments, pursuant to the ESA. Because these agencies have equities in regulatory actions that relate to ESA compliance, FEMA engaged with them early and throughout the regulatory planning and development process.

After an extensive coordination effort with the Services, FEMA has been unable to secure the Services' concurrence on Alternatives 3 or 4 of the NPEIS. In light of this, FEMA will continue to work with the Services to develop proposed changes pursuant to Section 7(a)(1) of the ESA, but any changes involving regulatory action will require a multi-year effort subject to an involved Agency review process. Thus, Alternatives 3 and 4 would not be feasible within the near-term timeframe in which the agency is looking to take action. FEMA would prefer to work in coordination with the Services when undertaking such extensive program changes in furtherance of its ESA Section 7(a)(1) responsibilities. Moreover, FEMA believes that success is more likely if the Services are partners in these efforts. As such, FEMA did not select these alternatives as the preferred alternative. FEMA will continue to work with the Services in their monthly meetings to look for additional opportunities to develop and implement program changes that benefit ESA-listed species and designated critical habitat in compliance with its Section 7(a)(1) responsibilities. The No Action Alternative (Section 2.4.1) would not meet the purpose and need.

REFERENCES

American Institutes for Research - Rosenbaum, W. and Boulware, G. (2006). *The Developmental and Environmental Impact of the National Flood Insurance Program: A Summary Research Report.* Retrieved December 2014, from http://www.fema.gov/media-library-data/20130726-1602-20490-5762/nfip_eval_dei_summary_report.pdf

FEMA. (2011, March). *National Flood Insurance Program: Answers to Questions about the NFIP*. Retrieved from https://www.fema.gov/media-library/assets/documents/272

O'Reilly v. U.S. Army Corps of Engineers, 477 F.3d 225, 236 (5th Cir. 2007).

Technical Mapping Advisory Council. (2015, December). *TMAC Future Conditions Risk Assessment and Modeling.* Retrieved from FEMA TMAC: https://www.fema.gov/media-library-data/1454954261186-c348aa9b1768298c9eb66f84366f836e/TMAC_2015_Future_Conditions_Risk_Assessment_and_Modeling_Report.pdf

Technical Mapping Advisory Council. (2016, June). *TMAC National Flood Mapping Program Review.* Retrieved from https://www.fema.gov/media-library-data/1474555532007-c063547f6f48026feb68c4bcfc41169d/TMAC_2016_National_Flood_Mapping_Program_Review_Updated.pdf

Page Intentionally Left Blank.

Table of Contents

List of Figures

List of Tables

Abbreviations and Acronyms

ACRONYM	DEFINITION
AARC	Average Annual Rate of Change
ACE	Accumulated Cyclone Energy
ACHP	Advisory Council on Historic Preservation
AIWW	Atlantic Intracoastal Waterway
B	Billion
BE	Biological Evaluation
BFE	Base Flood Elevation
BLM	Bureau of Land Management
CAA	Clean Air Act of 1970
CAFO	Concentrated Animal Feeding Operations
CBIA	Coastal Barrier Improvement Act of 1990
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
CH_4	Methane
CO_2	Carbon dioxide
CRS	Community Rating System
CSO	Combined sewer overflow
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
dB	Decibels
dBA	A-weighed decibel
DDT	dichloro-diphenyl-trichloroethane
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EAP	Environmental Action Plan
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat

ACRONYM	DEFINITION
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EVA	Evaluation, Visualization, and Analysis
FAA	Federal Aviation Administration
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMC	Fishery Management Councils
FMP	Fishery Management Plan
FRA	Federal Railroad Administration
GAP	Gap Analysis Program
GCM	Global Circulation Models
GHG	Greenhouse gas
HAPC	Habitat Areas of Particular Concern
HLW	High-level mixed waste
HRS	Hazard Ranking System
HUC	Hydrologic unit code
Hz	Hertz
IPCC	Intergovernmental Panel on Climate Change
kHz	Kilo Hertz
LLMW	Low-level mixed waste
M	Million
MBTA	Migratory Bird Treaty Act of 1918
MMPA	Marine Mammal Protection Act of 1972
MRCL	Multi-Resolution Land Characteristics Consortium
MSA	Magnuson-Stevens Fishery Conservation and Management Act of 1976
MTRU	Mixed transuranic waste
MW	Megawatt
MYA	Million years ago

ACRONYM	DEFINITION
N_2O	Nitrous oxide
NA	Not addressed
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NCP	National Contingency Plan
NEPA	National Environmental Policy Act of 1969
NFIA	National Flood Insurance Act of 1968
NFIP	National Flood Insurance Program
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
NIH	National Institutes of Health
NLCD	National Land Cover Database
NMSZ	New Madrid Seismic Zone
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPEIS	Nationwide Programmatic Environmental Impact Statement
NPHI	National Pipeline Hazard Index
NPL	National Priorities List
NPS	National Park Service
NRHP	National Register of Historic Places
O_2	Ozone
OPA	Otherwise Protected Areas
Pb	Lead
PHMSA	Pipeline and Hazardous Materials Safety Administration
P. Law	Public Law
PM	Particulate matter
POTW	Publicly owned treatment works
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act
RPA	Reasonable and Prudent Alternative
SFHA	Special Flood Hazard Area
SGA	Smart Growth America

ACRONYM	DEFINITION
SHPO	State Historic Preservation Office
SO_2	Sulfur dioxide
SSA	Sole source aquifer
TCP	Traditional Cultural Property
TDS	Total dissolved solids
TRI	Toxics Release Inventory
U.S.	United States
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCB	U.S. Census Bureau
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USVI	U.S. Virgin Islands

3 AFFECTED ENVIRONMENT

This chapter describes the existing environment that may be affected by implementing the proposed action and its alternatives, and serves as a baseline from which to identify and evaluate potential impacts. Aspects of the existing environment described in this section focus on "resource areas" that encompass the natural, human, and built environments. This chapter provides an overview on the units of analysis and resource areas eliminated from analysis, followed by descriptions of the Affected Environment for each resource area.

Resource Areas Presented in this Chapter and their Units of Analysis

Section 3.2.	**Air Quality**	
	Unit of Analysis:	*Nationwide*
Section 3.3.	**Noise**	
	Unit of Analysis:	*Nationwide*
Section 3.4.	**Land Use and Planning**	
	Unit of Analysis:	*FEMA Regions*
Section 3.5.	**Geology and Soils**	
	Unit of Analysis:	*USGS Physiographic Regions*
Section 3.6.	**Water Resources**	
	Unit of Analysis:	*USGS HUC-2 Watersheds*
Section 3.7.	**Biological Resources**	
	Unit of Analysis:	*Modified Anderson Classifications Within Physiogeographic Regions*
Section 3.8.	**Cultural Resources**	
	Unit of Analysis:	*FEMA Regions*
Section 3.9.	**Aesthetic and Visual Resources**	
	Unit of Analysis:	*USGS Physiographic Regions*
Section 3.10.	**Infrastructure**	
	Unit of Analysis:	*Nationwide*
Section 3.11.	**Hazardous Wastes and Materials**	
	Unit of Analysis:	*FEMA Regions*
Section 3.12.	**Socioeconomic Resources**	
	Unit of Analysis:	*FEMA Regions*
Section 3.13.	**Climate Change**	
	Unit of Analysis:	*NOAA NCDC Regions*

Modifications of National Flood Insurance Program (NFIP) components (mapping, insurance, and floodplain management) potentially impact all 50 States, 5 territories, and the District of Columbia (DC). Therefore, the proposed changes to the NFIP may be implemented in geographically diverse areas, including urban and rural areas, as well as previously disturbed and undisturbed (greenfield) sites. Although the Preferred Alternative primarily involves actions and potential impacts to the terrestrial environment, floodplains are transition zones between the upland and offshore environment; therefore, coastal aquatic or marine environments are also part of the Affected Environment.

The Affected Environment is described through 12 resource areas. Many Federal laws and regulations govern the protection and management of environmental and cultural resources in United States floodplains and adjacent areas. The NFIP Nationwide Programmatic Environmental Impact Statement

(NPEIS) addresses these requirements. Each resource area includes a discussion of the applicable laws and regulations. Additionally, summaries of laws and regulations relevant to the NFIP are provided in Appendix A.

Because the Preferred Alternative is national in scale, it was necessary to characterize the Affected Environment using appropriate and meaningful "units of analysis." The selected units of analysis breakdown the Action Area (Section 2.2), where possible, to support this NEPA evaluation, as well as provide context for evaluations of future projects.

3.1 UNITS OF ANALYSIS

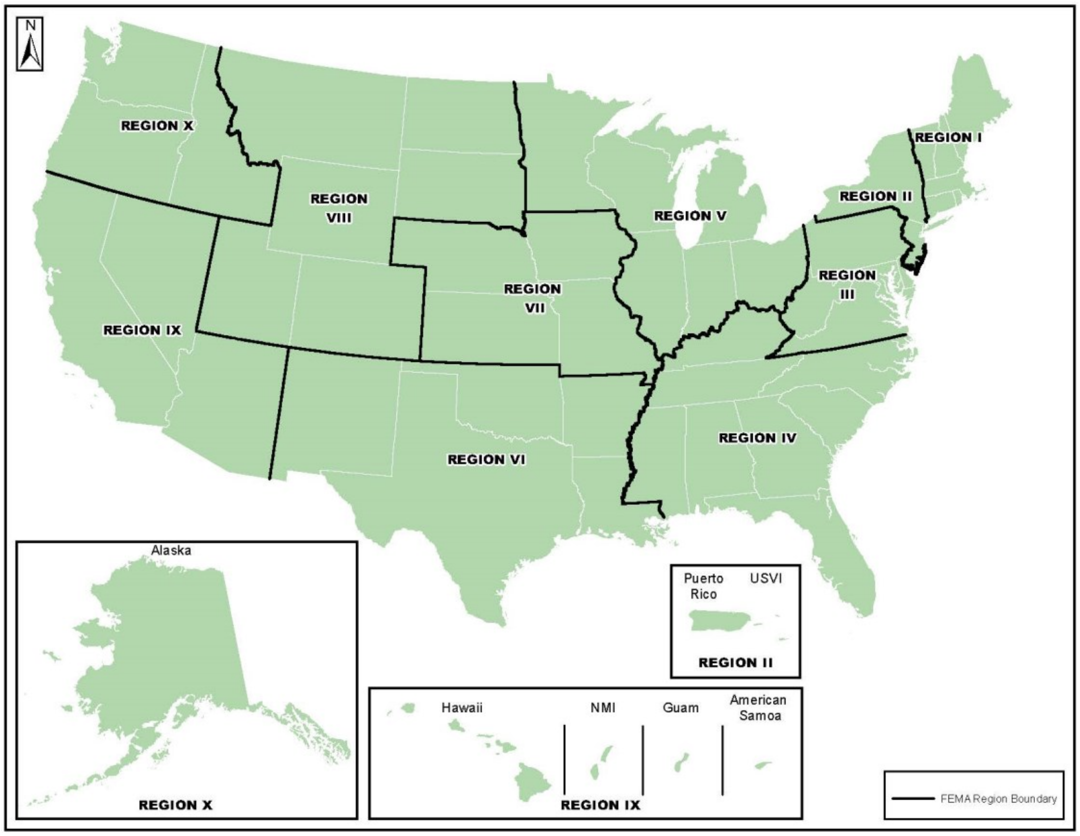
Different units of analysis were used to evaluate the 12 resource areas (refer to text box). Selection criteria for the units of analysis included:

- Reasonably sized sub-units that share sufficient attributes and features within the resource area,
- Relevancy to other data and analyses likely to support subsequent program/project analyses, and
- Precedence and support by other Federal agency programs.

Some units of analysis retained a nationwide overview given the nature of the resource areas. Below are summaries of the units of analysis used to describe the resource areas in this NPEIS.

3.1.1 FEMA Regions

Federal Emergency Management Agency (FEMA) delineates regions as geographic groups of States, through which the agency implements policy, managerial, resource, and administrative actions (Figure 3-1). Four of the resource area evaluations in this NPEIS use FEMA regions as the primary unit of analysis: Land Use and Planning, Cultural Resources, Hazardous Waste and Materials, and Socioeconomic Considerations. These resource areas use FEMA regions as the unit of analysis as data collection and regulation of the resource area elements are predominantly by States and regions.

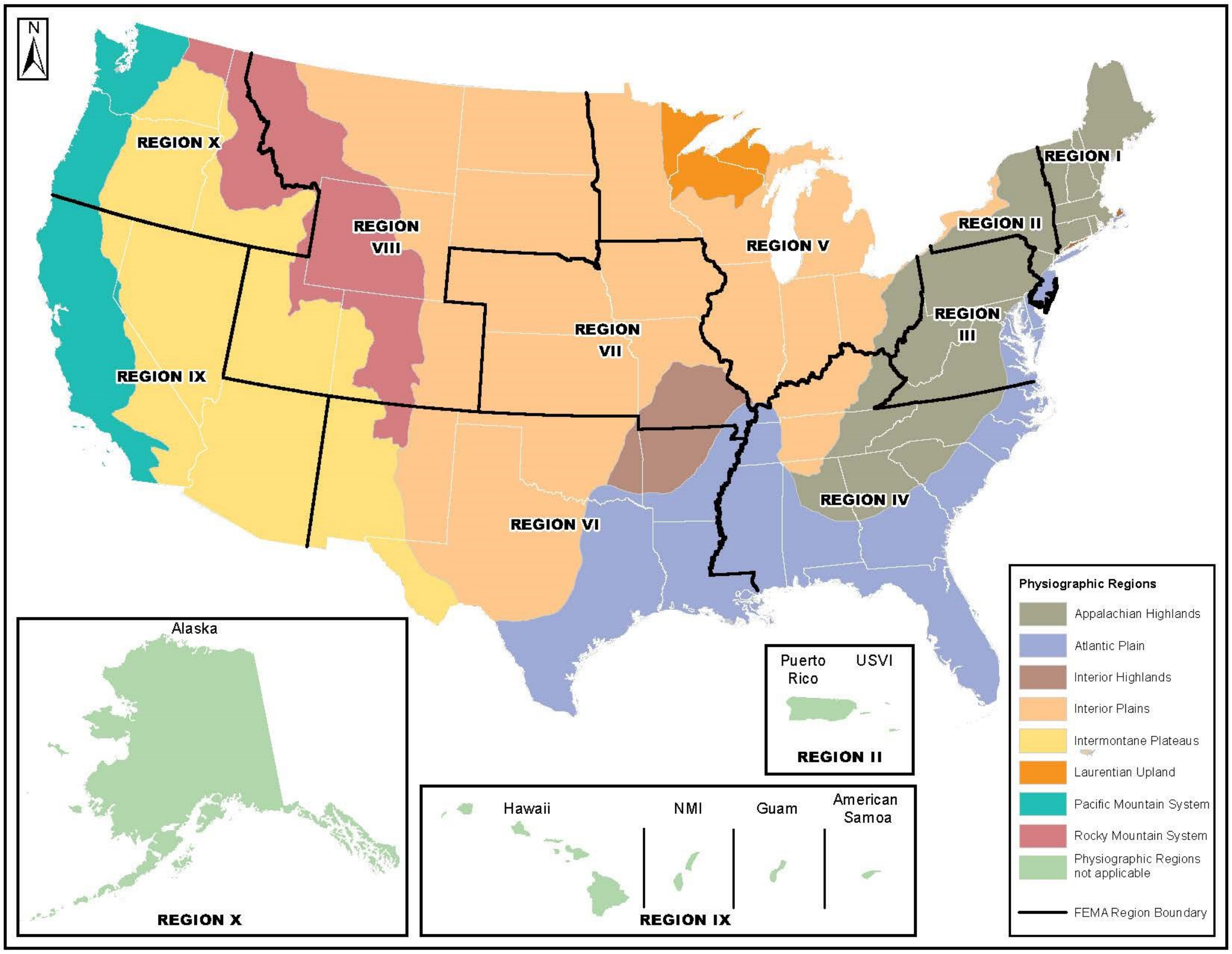


Source: (FEMA, 2013a)

Figure 3-1: FEMA Regions

3.1.2 USGS Physiographic Regions

United States Geological Survey (USGS) Physiographic Regions are landform descriptions described and delineated to characterize the underlying geology of a region (e.g., mountains, plains, etc.), which largely determines surface soils, sediments, floodplains, waterways, and a general view of the landscape (USGS, 2013a). The Bureau of Land Management (BLM) uses physiographic regions as a key component of the scenic quality evaluation process in their Visual Resource Management system (BLM, 2005a). Two resource area evaluations in the NPEIS use USGS Physiographic Regions as the primary unit of analysis: Geology and Soils, and Aesthetics and Visual Resources. Figure 3-2 shows the USGS physiographic regions within each FEMA region.



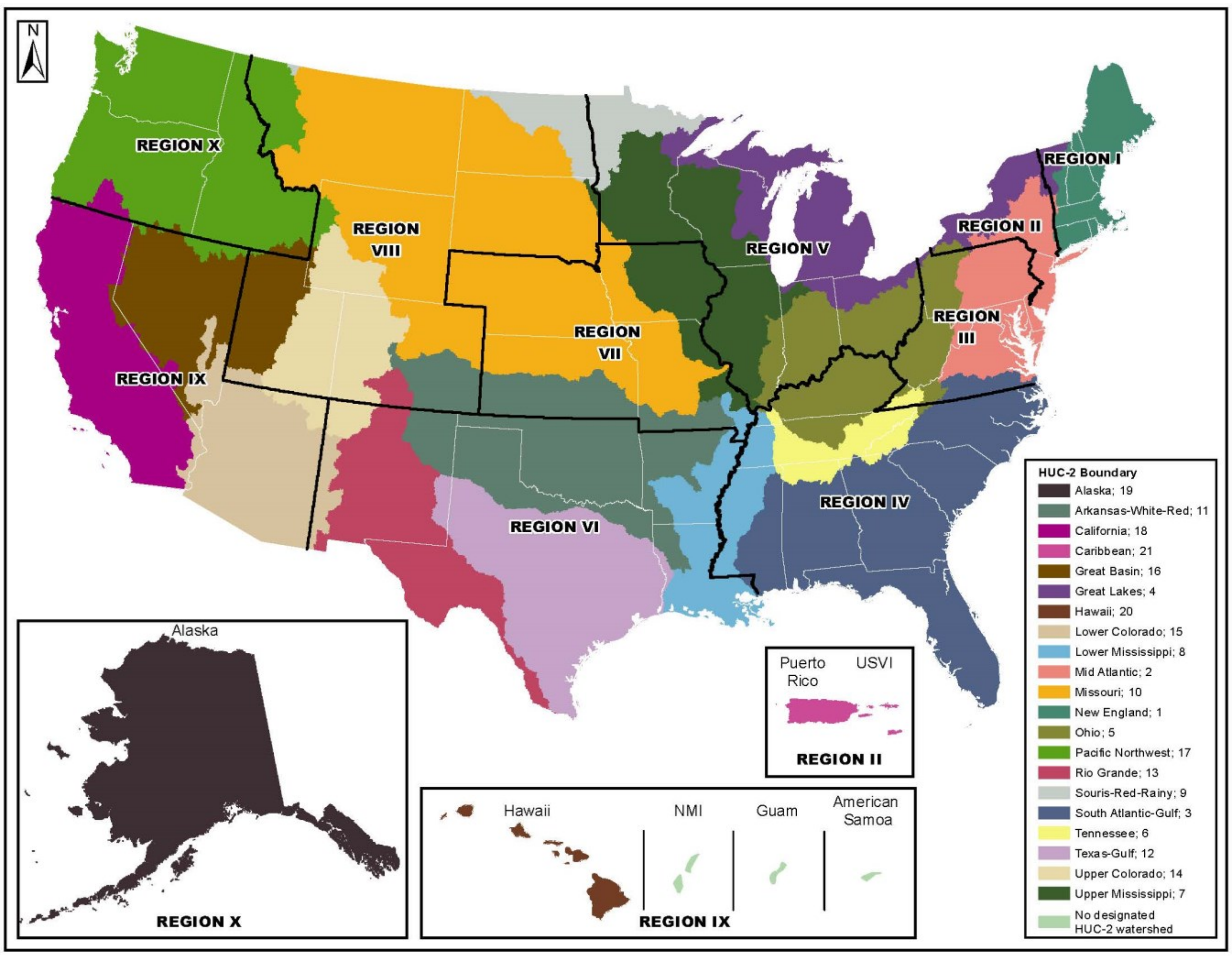
Source: (USGS, 2013a)

Figure 3-2: USGS Physiographic Regions and FEMA Regions

3.1.3 USGS Hydrologic Unit Code (HUC-2) Watersheds

The USGS has divided and sub-divided the United States into successively smaller watersheds, which are classified into regions, sub-regions, accounting units, and cataloging units (Natural Resources Conservation Service, 2014). A unique hydrologic unit code (HUC) is identified for each based on the four classification levels.

The HUC-2 classification (Figure 3-3) divides the nation into 21 major geographic areas, or regions, which contain either the drainage area of a major river or the combined drainage areas of a series of rivers (USGS, 2013b). There are 18 primary HUC-2 watersheds for the continental United States, plus Alaska, Hawaii, and the Caribbean (Puerto Rico and the Virgin Islands). The smallest HUC-2 watersheds cover only one State (or even a portion of a State as is the case of Texas). The larger HUC-2 watersheds (such as the Missouri River) cover multiple States with similar characteristics. FEMA selected the USGS HUC-2 Watersheds as the primary unit of analysis for the Water Resources evaluation.



Sources: (Natural Resources Conservation Service, 2014)

Figure 3-3: USGS HUC-2 Watersheds and FEMA Regions

3.1.4 Modified Anderson Classifications Within Physiogeographic Regions

The unit of analysis to describe biological resources is a slightly modified version of *A Land Use and Land Cover Classification System for Use with Remote Sensor Data* (the original Anderson land use/cover classifications) (Anderson, Hardy, Roach, & Witmer, 1976). Habitat classifications define ecosystem types, functions, and qualities, and are spatially disjointed throughout the United States. Broad physiogeographic regions serve as a spatial framework to facilitate research, assessment, management, and monitoring of ecosystems and ecosystem components of similar type, quality, and quantity. Physiogeographic regions provide spatial boundaries because they are descriptive and intended to broadly characterize the United States.

Anderson et al. describe land use/cover classifications across the United States in broad, simplified terms, which were found to be a suitable and practical method for a nationwide approach to classifying biological resources. Habitat classifications used in this analysis are based on the original Anderson land use/cover classifications (Anderson, Hardy, Roach, & Witmer, 1976), with some minor additions and modifications to the names and descriptions of some classifications to better fit the needs of this analysis. Figure 3-4 shows physiographic regions in the continental United States.

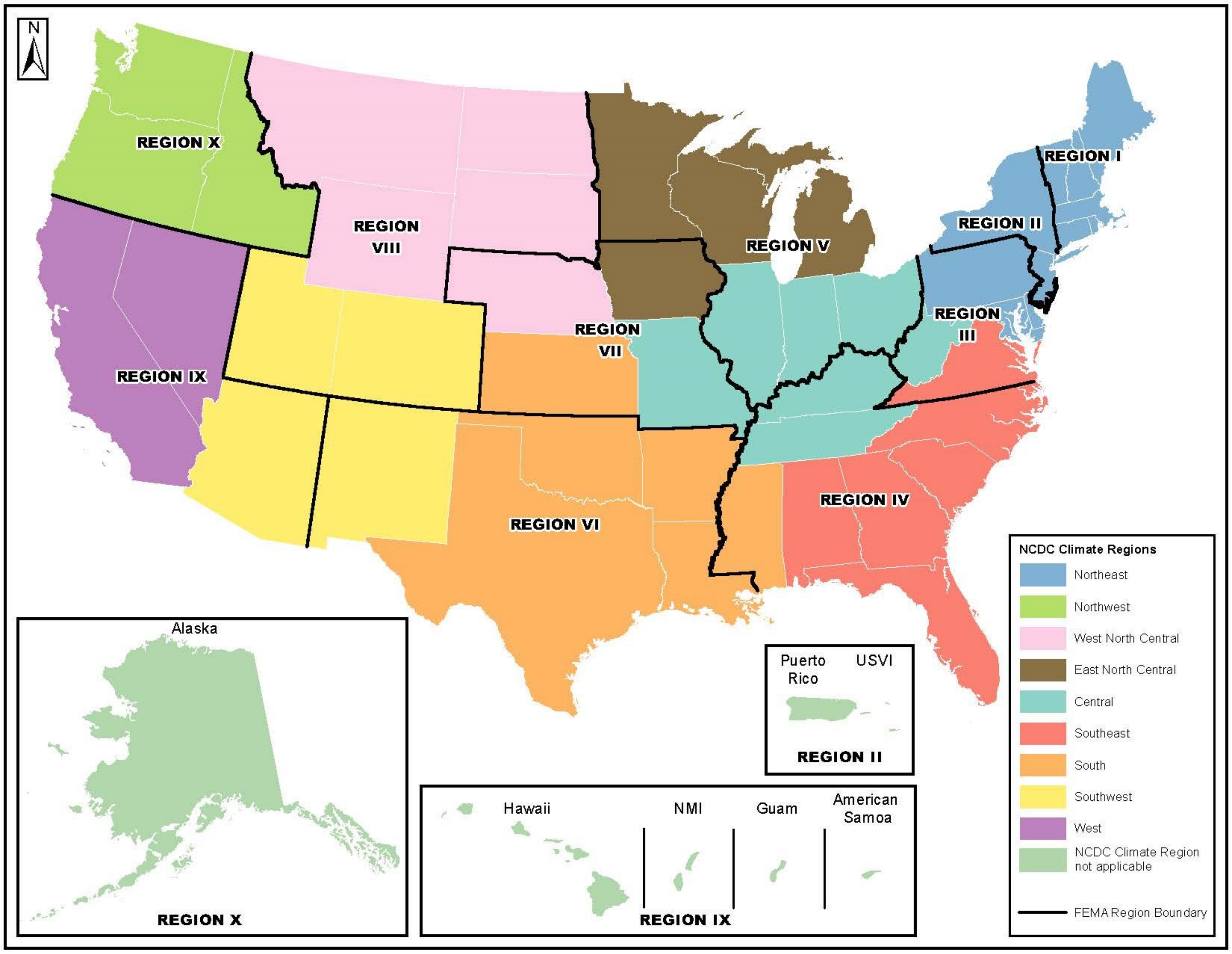
Source: (ESRI, 2016)

Figure 3-4: Physiogeographic Regions of the Continental United States

3.1.5 NOAA NCDC Regions

The Scientists at the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) identified nine climatically consistent regions within the contiguous United States (Figure 3-5), which are useful for putting current climate anomalies into a historical perspective (Karl & Koss, 1984). In general, NOAA NCDC Regions are delineated by similarities in temperature and precipitation.

FEMA selected NCDC Regions as the primary unit of analysis for the Climate Change resource area based on commonality and relevance of regional changes to temperature, precipitation, sea level, streamflow, and susceptibility to extreme storm events. Figure 3-5 shows the NOAA NCDC Regions within each FEMA region.



Source: (NCDC, 1984)

Figure 3-5: NOAA National Climate Change Data Center Regions and FEMA Regions

3.2 AIR QUALITY

Unit of Analysis
Nationwide

3.2.1 Definition of the Resource

In accordance with the Federal requirements of the Clean Air Act (CAA) of 1970 (42 U.S.C. §§ 7401-7671q), the air quality in a specific region or area is measured by the concentration of various pollutants in the atmosphere. The air quality in a region is a result not only of the types and quantities of atmospheric pollutants and pollutant sources in an area, but also surface topography, the size of the topological "air basin," and the prevailing meteorological conditions.

The CAA directed the EPA to develop, implement, and enforce strong environmental regulations that would ensure clean and healthy ambient air quality. To protect public health and welfare, EPA developed numerical concentration-based standards, or National Ambient Air Quality Standards (NAAQS), for pollutants that have been determined to affect human health and the environment. Primary NAAQS are ambient air quality standards that are required to protect public health with an adequate margin of safety, including protecting the health of sensitive populations such as asthmatics, children, and the elderly. Secondary NAAQS specify levels of air quality that are required to protect public welfare, including vegetation, crops, wildlife, economic values, and visibility.

Primary and secondary NAAQS are currently established for six criteria air pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and lead (Pb). The NAAQS establish various standards for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. The CAA requires States to designate any area that does not meet the national primary or secondary NAAQS for a criteria pollutant as a "nonattainment area" (42 U.S.C. §§ 7401-7671q).

In 1990, the CAA was amended to include the regulation of 187 hazardous air pollutants (HAPs) that were associated with cancer or other serious health effects. As with the NAAQS, HAPs originate from fixed sources (e.g., power plants, manufacturing facilities), mobile sources (e.g., cars, trucks, buses, construction vehicles), or indoor sources (e.g., building materials and cleaning processes). HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). The EPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health.

In 2009, the EPA modified Section 202(a) of the CAA to include greenhouse gases as air pollutants subject to regulation (EPA, 2013b). For this Preferred Alternative, greenhouse gases are evaluated as part of the Climate Change resource area within the NPEIS.

3.2.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. The CAA is an applicable law related to Air Quality.

3.2.2.1 Clean Air Act

The CAA is the primary Federal law designed to protect human health and the environment from the effects of air pollution. The law is administered by the EPA, in coordination with State, local, and Tribal governments, and the implementing regulations are codified at 40 C.F.R. Subchapter C, Parts 50-97. To protect public health and public welfare and to regulate emissions of hazardous air pollutants, the CAA requires the EPA to establish NAAQS for six "criteria pollutants" that threaten human health and welfare: O_3, CO, NO_2, SO_2, $PM_{2.5}$ and PM_{10}, and Pb.

3.2.3 Existing Conditions – Nationwide

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size, and topography[13] of the area, and the prevailing weather and climate conditions. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[14] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[15] The EPA designates areas within the United States as attainment,[16] nonattainment,[17] maintenance,[18] or unclassifiable[19] for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds, maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Table 3-1 below, presents the nonattainment and maintenance areas in the United States, as of June 17, 2016. The year(s) listed in the table for each pollutant indicate when EPA promulgated the standard for that pollutant; note that for $PM_{2.5}$ and SO_2, these standards listed are in effect. Approximately 57 million people nationwide lived in counties with pollution levels above the primary NAAQS in 2014 (EPA, 2016a).

Table 3-1: Nonattainment and Maintenance Areas by Pollutant Standard and County

Number of Counties	Pollutant and Year EPA Implemented Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$			O_3	SO_2	
	1971	1978	2008	1971	1987	1997	2006	2012	2008	1971	2010
Nonattainment	0	2	23	0	32	33	46	20	216	9	37
Maintenance	131	10	1	4	65	176	76	0	11	48	1
Total	131	12	24	4	88	208	121	20	227	56	38

Source: (EPA, 2016b)

[13] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[14] Equivalent to 1 milligram per liter (mg/L).
[15] Averaging Time: "The period over which data are averaged and used to verify proper operation of the pollution control approach or compliance with the emissions limitation or standard" (EPA, 2015a).
[16] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (EPA, 2015b).
[17] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (EPA, 2015b).
[18] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (EPA, 2015b).
[19] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (EPA, 2015b).

County subtotals and grand totals may not equal sum of the counties. Partial counties are only counted one time within groupings. Multi-State nonattainment (split) areas are not considered maintenance areas until all States in the area have been redesignated. Total maintenance counts do not include split areas.

The EPA creates air quality trends using measurements from monitors located across the country. Based on concentrations of the common pollutants, air quality has improved nationally since 1980. Emissions of the common air pollutants and their precursors have also reduced substantially since 1980. Emissions information is developed with input from State and local air agencies, tribes, and industry, from actual monitored readings or estimates of the amounts and types of pollutants emitted from various pollution sources (e.g., vehicles and factories). (EPA, 2016a)

The total emissions of the six principal air pollutants dropped by 63 percent between 1980 and 2014. Nationally, air pollution was lower in 2014 than in 1980: CO by 69 percent, Pb by 99 percent, nitrous oxide (N_2O) by 55 percent, direct PM_{10} by 58 percent, and SO_2 by 81 percent. However, between 1980 and 2013, CO_2 emissions increased by 17 percent (EPA, 2016a).

3.3 NOISE

Unit of Analysis
Nationwide

3.3.1 Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (EPA, 2012a). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety.

3.3.2 Applicable Statutes and Regulations

The proposed action must meet the requirements of NEPA and other applicable laws and regulations. The Noise Control Act of 1972 is an applicable law related to Noise.

3.3.2.1 The Noise Control Act of 1972

The Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. § 4901−4918]) initiated a Federal program to regulate noise to protect human health and minimize the public's annoyance from noise. The Noise Control Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. The Noise Control Act also serves to (1) establish a means for effective coordination of Federal research and activities in noise control; (2) authorize the establishment of Federal noise emission standards for products distributed in commerce; and (3) provide information to the public respecting the noise emission and noise reduction characteristics of such products. The EPA has developed noise guidelines for State and local governments (EPA, 1974).

3.3.3 Fundamentals of Noise

For environmental noise analyses, one quantitatively measures the effect of noise on the environment using decibels (dB) as the noise metric to describe the intensity of noise. Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain") (Occupational Safety and Health Administration, 2016). The pitch of a sound is determined by the vibration frequency measured as sound wave cycles per second [Hertz (Hz)]. The normal audible frequency range is approximately 20 Hz to 20 kilo Hertz (kHz) (FAA, 2015). The A-weighted scale approximates the range of human hearing by filtering out lower frequency noises; lower frequencies are not as damaging as the higher frequencies. Most ordinances and standards use the dBA scale (Occupational Safety and Health Administration, 2016).

Noise measurements and descriptions are based on various combinations of the following factors (Federal Transit Authority, 2006):

- Sound power level—the total sound energy radiated by a source.
- Sound pressure level—the actual air pressure changes experienced at a particular location (the frequency characteristics and sound pressure level combine to determine the loudness of a sound at a particular location).
- Sound duration.
- Changes in frequency characteristics or pressure levels through time.

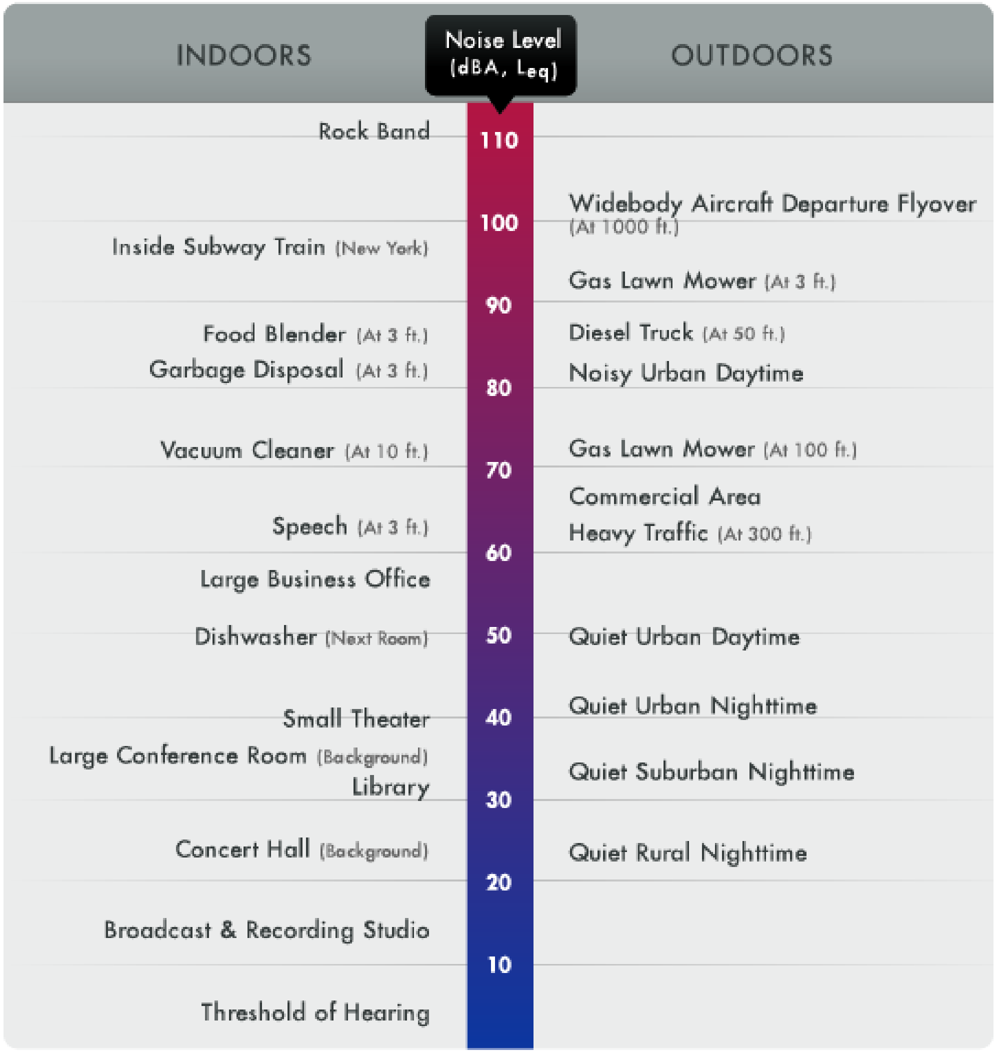
Figure 3-6 presents the sound levels of typical events that occur on a daily basis in the environment. For example, a band playing loud music may be as high as 120 dBA, whereas conversational speech is measured at about 55 to 60 dBA.

Sound levels cannot be linearly added or subtracted because of the logarithmic unit of measurement. There are two common methods of estimating sound levels to determine approximate sound levels. First, when adding two sounds of the same level, the sound level increases by about 3 dB (for example, 60 dB + 60 dB = 63 dB). Secondly, adding two sounds of different levels is slightly higher than the louder level (for example, 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in noise (dB) is categorized as follows (Federal Transit Authority, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causes an adverse response.

In general, ambient noise levels at night are about 10 dB higher than during the day (EPA, 1973). However, ambient noise levels can differ considerably depending on whether the environment is in an urban, suburban, or rural area.



Source: (Sacramento County Airport System, 2015)

Figure 3-6: Sound Levels of Typical Sounds

3.3.4 Existing Conditions—Nationwide

Noise from road traffic, aircraft, commercial trucks, construction equipment, and manufacturing and home activities—to name a few sources—are among the unwanted sources routinely broadcast into the environment. Research has indicated that noise can negatively affect the health and well-being of both humans and wildlife in many ways (Noise Pollution Clearinghouse, 2001). Responses to noise vary, depending on the type and characteristics of the noise, time of day, dB level of noise, distance between the receptor and noise source, and the receptor's sensitivity. Noise-related concerns in humans are typically hearing loss and hearing impairment; however, humans may exhibit stress, sleep loss, distraction, loss of productivity, and quality of life concerns due to noise. Socially, noise can provoke annoyance responses and changes in behavior. For wildlife, noise can disrupt feeding and foraging, migration, and nesting. The effects of noise can be immediate or latent as a result of long-term exposure. (Berglund, Birgitta, & Lindvall, 1995) (EPA, 1974)

Ambient noise levels vary widely based on the location and environment of the area. Figure 3-6 illustrates noise values for typical community settings and activities that are representative of what people in the United States may experience on a daily basis. These noise levels represent a wide range and are not specific to any one particular State.

In general, there are areas within a State where the population can potentially be exposed to higher than average noise levels. The following describes those areas that may experience higher noise levels:

- **Urban Environments:** On a daily basis, urban areas are more likely to exhibit higher noise levels resulting from highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (Department of the Interior, 2008). Major population centers in each State would be considered urban environments.
- **Airports:** Cities and towns located near airports may experience higher levels of noise due to daily aircraft operations. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2015). However, commercial aircraft emit noise levels between 70 to 100 dBA depending on the aircraft type and associated engine (FAA, 2012). Aircraft noise is perceived differently based on the altitude of the aircraft and the distance of the aircraft to the point of measurement. Operations at an airport are primarily arrivals and departures of commercial aircraft, but some airports have aircraft that conduct touch-and-go operations (e.g., general aviation or military aircraft). Most, but not all, commercial airports in the United States are located near urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas at higher levels. Peak operations (early morning and in the evenings) have the potential for increased noise levels due to an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas.
- **Highways:** Communities near major highways may experience higher than average noise levels in comparison to areas that are not close to a highway (Department of Transportation, 2015). There are a number of major highways within each State that may contribute to higher ambient noise levels for communities located in proximity to these roadways. Major highways tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (Department of Transportation, 2015).
- **Railways:** Similar to highways, railways typically have higher than average ambient noise levels for communities living in close proximity (Federal Transit Authority, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA for a locomotive horn ringing out at a crossing (FRA, 2015). Multiple rail corridors are present in the United States with high levels of commercial and commuter rail traffic.
- **National and State Parks:** Many national and State parks are located in remote wilderness areas and are likely to have lower than average ambient noise levels given their size and location. National and State parks, historic areas, and monuments are protected areas and typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014a). Visitors to these areas expect lower ambient noise conditions than urban areas.

3.4 LAND USE AND PLANNING

Unit of Analysis
FEMA Regions

3.4.1 Definition of the Resource

Land use can be defined as the management and modification of natural resources and the environment into a built environment that may include settlements, residential areas, commercial and industrial areas, semi-natural habitats, and natural habitats. Land use often refers to real property classifications that indicate either natural conditions or the types of human activity that occur or are permitted on a parcel. There is no nationally recognized convention or uniform terminology for describing land use categories. As a result, the meanings of land use descriptions and definitions vary among jurisdictions.

Land use plans are usually established to ensure that development proceeds in an orderly, informed fashion, encouraging compatible uses for adjacent lands and establishing boundaries for urban growth through the extension of public services, such as sewer and water service, which may encourage development. Master plans are generally written by an entity such as a county, municipality, or land-managing agency to provide a long-term strategy for growth and development.

This section provides an overview of: (1) land cover classes and the general uses within each land type, and (2) planning activities with the NFIP's Community Rating System (CRS). When State and local governments make land use and planning decisions that affect a community's floodplains, the decision can impact the community's standing within the NFIP and CRS. The unit of analysis for land use and planning, FEMA regions, was selected to provide a logical set of geographic/administrative boundaries for analyzing land use and planning approaches of State and local governments throughout the nation.

3.4.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. A discussion of the applicable laws and regulations for Land Use and Planning[20] are provided below.

3.4.2.1 Coastal Barrier Resources Act of 1982

The Coastal Barrier Resources Act (CBRA) (Pub. L. 97–348, 16 U.S.C. §§ 3501–3510, 42 U.S.C. § 4028), administered by the U.S. Fish and Wildlife Service (USFWS), was enacted to protect sensitive and vulnerable barrier islands found along the United States Atlantic, Gulf, and Great Lakes coastlines. The CBRA established the Coastal Barrier Resources System (CBRS), which is composed of relatively undeveloped coastal barrier islands, including those in the Great Lakes. The areas protected under CBRA include CBRS protected system units and Otherwise Protected Areas (OPAs). Areas contained within the system are ineligible for direct or indirect Federal funds, to include flood insurance policies through the NFIP that might support or promote coastal development, thereby discouraging development in coastal areas.

[20] In addition to Federal laws and regulations, Standard Enabling Acts (also known as the Standard Acts) are used at the State and local level to establish a standard framework for the planning and regulation of land use and development. FEMA sets certain nationally applicable minimum floodplain management criteria related to reducing flood hazard risk in floodplain areas for all NFIP participating communities. These minimum criteria must be incorporated into community ordinances and regulations as a condition of participation in the program. Communities incorporate these requirements into their zoning codes, subdivision ordinances, or building codes, or adopt special purpose floodplain management ordinances.

The CBRS areas are located in nearly 400 communities on the Atlantic and Gulf coasts and along the Great Lakes shores, and cover an estimated 3 million acres. These areas are delineated on the communities' flood maps. The CBRS currently includes 585 System units, encompassing approximately 1.3 million acres of land, and associated aquatic habitat. CBRS system units are usually relatively undeveloped private lands at the time of designation within the CBRS. Most new Federal expenditures and financial assistance, including Federal flood insurance, are prohibited within system units. (USFWS, 2015a)

Otherwise Protected Areas are generally lands held by a qualified organization primarily for wildlife refuge, sanctuary, recreational, or natural resource conservation purpose. The CBRS currently includes 272 OPAs, encompassing approximately 1.9 million acres of land and associated aquatic habitat. The only Federal spending prohibition within OPAs is the prohibition on Federal flood insurance. (USFWS, 2015a)

3.4.2.2 Coastal Barrier Improvement Act of 1990

The Coastal Barrier Improvement Act of 1990 (CBIA) (Pub. L. 101-591) is administerd by the USFWS. The CBIA reauthorized the CBRA and expanded the CBRS to include undeveloped areas in Florida, Puerto Rico, the United States Virgin Islands, and areas surrounding the Great Lakes. Additionally, the CBIA established a new category of coastal barriers, OPAs, and provides additional protections to coastal areas within the boundaries of lands protected under Federal, State, or local law, or held by a qualified public or non-profit conservation organization. These lands are primarily used as wildlife refuges, sanctuaries, natural resource conservation, or for recreational purposes. (USFWS, 2015a)

3.4.2.3 Coastal Zone Management Act of 1972

The Coastal Zone Management Act (CZMA) is administered by the Department of Commerce's Office of Coastal Resource Management and NOAA and applies to all coastal States and to all States that border the Great Lakes. The CZMA was established to help prevent additional loss of living marine resources, wildlife, and nutrient-enriched areas; alterations in ecological systems; and decreases in undeveloped areas available for public use. The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active State involvement in achieving these goals. The CZMA requires participating coastal States to develop coastal zone management programs to effectively manage coastal zones within State boundaries. Each State Coastal Zone Management (CZM) program must include provisions protecting coastal natural resources, fish, and wildlife; managing development along coastal shorelines; providing public access to the coast for recreational purposes; and incorporating public and local coordination for coastal decision-making. Upon Federal approval of a State's coastal zone management program, the State becomes eligible for Federal coastal zone grants. Development projects within the coastal zone must demonstrate compatibility with the State's coastal zone program and apply for a coastal zone permit. Additionally, review by other regulatory agencies, such as the USFWS and NOAA Fisheries is typically part of a coastal zone permit review.

For projects in the coastal zone that are funded, authorized, or carried out by a Federal agency, a Federal consistency determination is submitted to the State as confirmation that the project is consistent with the State coastal zone program. The CZMA gives States the authority to determine whether activities of governmental agencies are consistent with federally approved CZM programs. Any activities approved by communities participating in the NFIP that may have an effect on any land or water use or on any natural resources in the coastal zone must conform to the enforceable policies of the approved State CZM program. This voluntary Federal-State partnership addresses coastal development, water quality, shoreline erosion, public access, protection of natural resources, energy facility siting, and coastal hazards.

3.4.2.4 National Flood Insurance Act

The National Flood Insurance Act of 1968 (NFIA) contains several provisions that relate directly to land use and planning. Section 4022 of the NFIA, *State and Local Land Use Controls*, establishes the CRS. The three goals of the CRS are to reduce and avoid flood damage to insurable property, strengthen and support the insurance aspect of the NFIP, and to foster comprehensive floodplain management. The CRS provides incentives for communities to do more than regulate to the minimum standard required for participation in the NFIP. In return, homeowners in participating communities receive additional discounts on their flood insurance policy premiums to reflect the community's efforts to further reduce the impacts of flood damage and undertake additional, more comprehensive floodplain management activities that will address concerns beyond those of insurable property. There are 10 CRS classes, with Class 1 being the most highly rated, and receiving the greatest discount on insurance. A community that does not apply for the CRS, or does not obtain the minimum number of credits, is considered a Class 10 community, and receives no discounts. (FEMA, 2013b)

Additionally, NFIA Section 4102, *Criteria for Land Management and Use*, authorizes FEMA to carry out studies and investigations that address the adequacy of State and local measures in flood-prone areas as to land management and use, flood control, flood zoning, and flood damage prevention. It also gives FEMA the authority to develop criteria that encourage NFIP participating communities to adopt adequate measures to constrict the development of flood-prone lands, guide proposed development away from those lands, assist in reducing flood damage, and improve the long-range management and use of flood-prone areas.

3.4.2.5 Executive Order 11988 (Floodplain Management)

Executive Order (EO) 11988, *Floodplain Management*, contains land use planning direction for Federal agencies, applying to both direct and indirect activities. It requires Federal agencies to "avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" and to use the 100-year flood as the base flood standard for the NFIP (FEMA, 2012a).

EO 11988 affects actions including the acquisition, management, and disposal of Federal facilities and land; federally undertaken, financed, or assisted construction and improvements; and Federal programs and activities affecting land use (42 *Federal Register* [FR] 26951). Prior to any Federal action, the agency must conduct an 8-step process to determine whether the proposed action will occur in the floodplain; identify and evaluate practicable alternatives "to avoid adverse effects and incompatible development in the floodplains;" identify the impacts of the proposed action; develop measures to minimize potential harm to people, property, and floodplains; and provide an opportunity for public review and comment.

3.4.2.6 EO 11990 (Protection of Wetlands)

EO 11990, *Protection of Wetlands*, contains land use planning provisions that require Federal agencies to avoid the destruction or modification of wetlands, and to avoid direct or indirect support of development activities in wetlands if a practicable alternative is available. As with EO 11988, it requires Federal agencies to use the 100-year flood as the base flood standard for the NFIP. Before implementing an action that is in, or may affect, a wetland, EO 11990 requires Federal agencies to demonstrate that there is no practical alternative and the proposed action includes all practical measures to minimize harm to the wetland. The Federal agency must also provide opportunity for early public review by those who may be affected and include the Agency's findings in its environmental or other appropriate decision documents.

3.4.3 Existing Conditions—Land Cover and Land Use Definitions

Although there is no nationally recognized convention or uniform terminology for describing land use categories, the Anderson Land Use and Land Cover Classification System (Anderson, Hardy, Roach, & Witmer, 1976) has been used by the USGS and other Federal agencies as the basis for land cover analysis. This system was used by the USGS Land Cover Institute to create the National Land Cover Database (NLCD). Land cover types from the NLCD are summarized in Table 3-2 and provides the primary basis for analysis of land use.

Table 3-2: Summary of Land Cover Classes for the Conterminous United States

(Excluding land cover types found only in Alaska, including Classes 51, 72, 73, 74)

Class No.	Land Cover Type	Percentage
11	Open Water	5.18
12	Perennial/Ice Snow	0.02
21	Low Intensity	3.25
22	High Intensity	1.44
23	Commercial/Industrial/Transportation	0.57
24	Developed High Intensity	0.20
31	Bare Rock/Sand/Clay	1.21
41	Deciduous Forest	10.99
42	Evergreen Forest	11.90
43	Mixed Forest	2.06
52	Scrub/Shrub	21.36
71	Grasslands/Herbaceous	14.47
81	Pasture/Hay	6.73
82	Cultivated Crops	15.51
90	Woody Wetlands	3.87
95	Emergent Herbaceous Wetlands	1.25

Source: (USGS, 2013b)

The following sub-sections describe essential characteristics of each land cover type, as well as typical land uses, if applicable. Similar land cover types are grouped where appropriate to streamline the discussion.

3.4.3.1 Water

There are two classes associated with water: open water, and perennial ice/snow. In open water (Class 11), less than 25 percent of land cover is vegetation or soil. This land class may be used for fishing, aquaculture, and other water-dependent commercial practices. In perennial ice/snow (Class 12), ice and snow is generally 25 percent or more of total cover. (USGS, 2013b) More information about water resources is included in Section 3.6.

3.4.3.2 Developed Land

There are four classes of developed land in the NLCD, each with unique characteristics and associated uses. These four land cover classes are low intensity (Class 21); high intensity (Class 22); commercial, industrial, and transportation (Class 23); and developed high intensity (Class 24). The low intensity land cover class is composed of some constructed materials, but primarily vegetation in the form of lawn grasses or other landscaping. Land uses associated with this cover type include large lot, low-density residential development, parks, golf courses, and either functional or aesthetic landscaping, such as gardens, swales, erosion control plantings, or other recreational areas. The high intensity land cover class has a higher ratio of constructed materials to vegetation. Land uses associated with this land cover type are typically moderate density single-family residential development, with a range of 4 to 12 units per acre. The commercial, industrial, and transportation land cover class includes medium intensity developed land that is a mixture of constructed materials and vegetation. The developed high intensity land cover class is associated with very highly developed and intensively used areas. Typical land uses associated with this cover type include commercial and industrial properties and high-density residential development such as apartment complexes and row houses. This includes federally owned land such as office buildings, military installations, and other properties. (USGS, 2013b)

3.4.3.3 Bare Rock, Sand, Clay

Bare rock/sand/clay is characterized as areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for no more than 15 percent of total land cover (USGS, 2013b). Land uses vary widely, from recreational areas to industrial mining/extraction operations.

3.4.3.4 Forest Land

There are three classes of forestland in the NLCD: deciduous, evergreen, and mixed. Overall characteristics of forestlands are areas dominated by trees generally greater than 5 meters tall, which constitute more than 20 percent of total vegetation cover. For a forest to be classified as deciduous (Class 41), more than 75 percent of its trees must shed foliage in response to seasonal change, whereas evergreen forests (Class 42) contain 75 percent or more of trees that maintain foliage year-round. In a mixed forest (Class 43), neither deciduous nor evergreen species constitute more than 75 percent of total tree cover (USGS, 2013b). Of the roughly 751 million acres of forest area in the nation, deciduous forests cover 290 million acres (39 percent), evergreen forests cover 409 million acres (54 percent), and mixed forests cover 50 million acres (7 percent) (USFS, 2014). Land uses in forests include logging and agroforestry operations, recreation, and open space. These lands may also be federally owned as parks, national forests, forest preserves, research stations, and other uses.

3.4.3.5 Shrubland

There are two classes of shrubland in the NLCD: dwarf scrub and scrub/shrub. Dwarf scrub (Class 51) is found only in Alaska and is dominated by shrubs less than 20 centimeters tall; the shrub canopy is greater than 20 percent of total vegetation. Grasses, sedges, herbs, and non-vascular vegetation often occur in this classification. Scrub/shrub (Class 52) is dominated by shrubs less than five meters tall and may also include young trees; the shrub canopy is greater than 20 percent of total vegetation. These lands typically remain as open space, although they may be developed for a wide variety of uses; there are no land uses associated with these land cover types. (USGS, 2013b)

3.4.3.6 Herbaceous

There are four classes of herbaceous land cover, which are defined by non-woody vegetation. Grasslands/herbaceous (Class 71) typically contain 80 percent or more of grasses or other herbaceous vegetation; they are not subject to intensive management practices such as tilling, but may be used for grazing. The remaining three classes, sedge/herbaceous (Class 72), lichens (Class 73), and moss (Class 74), are types of tundra plant communities, found only in Alaska (USGS, 2013b). These lands typically remain as open space; there are no land uses associated with these land cover types.

3.4.3.7 Planted/Cultivated

There are two classes of planted/cultivated land cover, both agricultural in nature. Pasture/hay (Class 81) is composed grasses, legumes, or mixtures of the two planted for the purpose of grazing livestock, or raising seed or feed crops. Vegetation associated with this use accounts for more than 20 percent of total vegetation. Cultivated cropland cover (Class 82) is used for the production of annual crops such as corn, soybeans, wheat, vegetables, and cotton, and also includes perennial woody agriculture, such as orchards and vineyards, and all land that is actively being tilled. Crop vegetation must account for more than 20 percent of the total vegetation (USGS, 2013b). These land classes are used for producing food crops or raising livestock.

3.4.3.8 Wetlands

There are two wetland classes: woody wetlands and emergent herbaceous wetlands. Woody wetlands (Class 90) are areas that contain 20 percent or more forest or shrubland vegetation, and where the soil is periodically saturated or inundated with water. Emergent herbaceous wetlands (Class 95) are those areas where perennial herbaceous vegetation accounts for 80 percent or more of vegetative cover and the soil is periodically saturated or inundated with water. There are no land uses associated with wetlands. (USGS, 2013b)

3.4.4 Existing Conditions—Planning, CRS, and Floodplain Management Criteria

3.4.4.1 Planning Generally

Planning varies significantly from State to State, with some having a State Planning Department, others relying on Regional Planning Councils (RPCs) or Council of Governments (COGs), and others enacting comprehensive planning legislation to require municipalities to develop comprehensive plans. While many municipalities may choose to develop comprehensive plans even in the absence of such legislation, it codifies the framework for planning and development in those States that choose to enact it.

A comprehensive plan is intended to provide a complete community-oriented vision for the future. Typical comprehensive plans address land use, demographics, housing, infrastructure, education, economic investment and development, recreation, and thoroughfares. Comprehensive plans not only lay out goals for the future, but they also establish the process and policies through which those goals will be achieved. Most States that mandate comprehensive planning at the local level also require the inclusion of hazard mitigation planning (Schwab, 2011). A hazard mitigation plan is a plan to identify risks and vulnerabilities associated with natural and manmade disasters and develop long-term strategies for protecting people and property from future hazard events.

Incorporating hazard mitigation planning into a comprehensive plan enables a community to plan and implement a more coordinated and efficient response in the event of a disaster. It also ensures that the goals and actions in a community's hazard mitigation plan are consistent with those in the comprehensive plan and, therefore, can be successfully implemented through local land use codes and other policy mechanisms. Additionally, it provides the opportunity for elements of the comprehensive plan, such as infrastructure planning and building codes, to be more effectively considered in light of hazard mitigation principles.

Although all States have the authority to implement planning and zoning, as granted by the Standard State Zoning Enabling Act, the degree to which these activities are implemented varies from State to State. Some States have comprehensive planning laws that mandate comprehensive planning down to the local level, while others do not. Regional variations in comprehensive planning are discussed further below.

3.4.4.2 Floodplain Management and Planning

FEMA sets certain nationally applicable minimum floodplain management criteria related to reducing flood hazard risk in floodplain areas for all NFIP participating communities. Based on 44 C.F.R. § 60, *Emergency Management and Assistance—Criteria for Land Management and Use*, "Federal flood insurance shall not be sold or renewed under the program [NFIP] within a community, unless the community has adopted adequate floodplain management regulations consistent with Federal criteria" [44 C.F.R. § 60.1(a)]. Minimum requirements for floodplain management mandate that a community ensure that its comprehensive plan is consistent with the floodplain management objectives of Part 60 (44 C.F.R. § 60.2). These minimum floodplain management criteria must be incorporated into community ordinances and regulations as a condition of participation in the NFIP. Communities incorporate these requirements into their zoning codes, subdivision ordinances, or building codes, or adopt special purpose floodplain management ordinances.

3.4.4.3 Community Rating System (CRS) and Planning

State and local communities plan and regulate land use and development through zoning. As described in Section 1.3, through the NFIP, FEMA sets certain nationally applicable minimum floodplain management criteria related to reducing flood hazard risk in floodplain areas for all NFIP participating communities. Based on 44 C.F.R. § 60 (Emergency Management and Assistance—Criteria for Land Management and Use), Federal flood insurance shall not be sold or renewed within a community unless the community has adopted adequate floodplain management regulations consistent with Federal criteria [44 C.F.R. § 60.1(a)]. Minimum requirements for floodplain management mandate that a community ensure that it is comprehensive plan consistent with the floodplain management objectives of Part 60 [44 C.F.R. § 60.2]. These minimum floodplain management criteria must be incorporated into community ordinances and regulations as a condition of participation in the NFIP. Communities incorporate these requirements into their zoning codes, subdivision ordinances, or building codes, or adopt special purpose floodplain management ordinances.

Communities that participate in the NFIP also have the option to participate in the NFIP Community Rating System (CRS). The CRS is a voluntary program that provides flood insurance premium discounts to flood insurance policy holders in communities implementing floodplain management programs that exceed the minimum floodplain management criteria, as described in Section 1.3.1.1. The CRS provides two important opportunities to participating communities. First, it recognizes those communities that are implementing floodplain management practices that achieve greater flood damage reduction than available through the minimum floodplain management criteria of the NFIP. Secondly, it provides an incentive to communities to implement floodplain management practices in the future that will lead to flood insurance premium discounts. The CRS also recognizes best practices implemented by communities today and provides a roadmap for future land use planning.

The CRS encourages the use of higher minimum floodplain management criteria for communities to proactively protect their citizens and businesses from flooding. The CRS recognizes, fosters, and rewards—through use of flood insurance premium discounts—community and State activities that go beyond the minimum requirements of the NFIP to:

- Reduce and avoid flood damage to people and property;
- Strengthen and support the NFIP insurance program; and
- Foster comprehensive floodplain management planning.

There are nine CRS classes that provide a flood insurance premium discount. A CRS rating of a Class 9 provides a five percent premium discount to flood insurance policies in the Special Flood Hazard Area (SFHA). As a community engages in additional floodplain management activities, their rating improves in 500-point increments. A CRS Class 1 is the most advanced CRS Class rating, and policyholders in communities in this class are afforded a 45 percent premium discount.

The CRS provides a unique opportunity to motivate communities that desire to use the insurance premium discount program as an incentive and justification for forward-looking comprehensive land use planning. The NFIP minimum floodplain management standards described in Section 1.3.1.1 are applicable nationwide. However, for certain communities with more complex flood risk, these minimum standards may only be appropriate as a starting point for a more comprehensive approach to land use planning and flood control measures. Flooding characteristics faced by communities vary greatly across the nation. Land-use patterns, urbanization, extreme coastal flood risk, subsidence, erosion risk, population demographics, and community capability can all vary widely for communities. The CRS provides an opportunity for individual communities to undertake planning strategies, evaluate their flood risk, implement best practices, and, in exchange, to receive flood insurance premium discounts for policyholders in CRS communities.

Through multi-year strategies, CRS communities can plan floodplain management initiatives that influence land-use planning and lead to safer occupancy of floodplain areas. For most CRS communities, community planning includes development limitations in floodprone areas and the preservation of open space. As of October 2016, there were 1,416 NFIP participating communities that participate in the CRS, which is approximately 69 percent of all NFIP policies. Many of these CRS communities are communities with very large numbers of flood insurance policies and communities in locations undergoing a pattern of new development in floodprone areas. Many CRS communities in the "introductory" CRS Classes, i.e., Class 9 and Class 8, are implementing floodplain management programs that exceed the minimum NFIP floodplain management standards by a minimal or marginal degree. There are 701 CRS Class 9 and 8 communities. However, as communities progress through more advanced CRS Classes into the "advanced" level classes, i.e., CRS Class 5 through 1, their floodplain management programs are more strategic, comprehensive and effective in reducing flood damages. The CRS provides a logical path for communities that want to advance their floodplain management programs and incorporate a multi-year planning process to achieve their goals.

It is worth noting that many of the most advanced CRS communities are communities that have suffered extreme flooding events on more than one occasion or experience less severe but recurring flooding. As these communities tackle the difficult transition from response through recovery and into long-term planning, the CRS provides a suite of activities and best practices these communities can build upon to plan their future. The CRS credits for preservation of open space, higher regulatory standards, floodplain management planning, public education and outreach, as well as other CRS activities, provide these communities a framework to pursue a vison for themselves that enhances the natural functions and attractions of floodplains while reducing the risk to property and life safety.

Several of the CRS activities identified by FEMA influence land use development and planning. Open Space Preservation, CRS Activity 420, is an effective way to prevent flood damage by keeping floodprone areas as undeveloped and open space (land with no buildings, pavement, barriers, etc.). Communities receive CRS credit when wetlands, natural areas, and beaches are protected from development. Even more CRS credits are provided when the areas preserved as open space are located within an SFHA or are deeded to restrict development for future years. Additional credit is also offered when measures are implemented that require or encourage less development, such as open-space incentives, low density zoning, and natural shoreline protection credit programs. This activity supports the designation of areas to be preserved as open space, which is a prominent element of community land use planning. Open space can achieve numerous benefits including water quality protection, storm water runoff control, aquifer and well water protection, wildlife habitat conservation, retention of residential property values, outdoor recreation enhancements, to name a few.

Higher Regulatory Standards, CRS Activity 430, recognizes community higher standards. In areas where there is recurring flood damage, there are associated high rates of business foreclosure, costly effects upon emergency services, and unstable housing resources. These are the very kinds of undesired consequences that land use planning seeks to avoid, and use of higher regulatory standards for new construction is one way to help avoid such adverse consequences. (FEMA, 2015a) (FEMA, 2005)

Examples of higher standards that are incorporated into community land use planning by CRS communities, and the benefits that they can provide, include the following:

- Prohibiting fill and other ground-altering measures can protect existing development and habitat, improve water quality, and maintain the flood attenuating benefits of natural areas;
- Requiring compensatory storage preserves areas of the floodplain that can store flood water and minimizes increases in flood heights due to development;
- Requiring the lowest floors of residences to be higher than the base flood elevation (BFE) protects buildings from higher floods;
- Requiring full compliance with floodplain management regulations when proposed improvements or repairs are less than 50 percent of a building's value brings more nonconforming buildings up to current flood protection standards;
- Protecting critical facilities to higher levels reduces damage to those facilities and improves the community's ability to respond to the needs of citizens during a disaster;
- Adopting and enforcing a building code improves the quality of construction of new buildings and provides more staff support for floodplain management regulations;
- Standards for protecting buildings from local drainage problems reduce flood losses and flood insurance claims, especially outside the floodplain;
- Requiring new manufactured housing in existing manufactured housing parks to meet the same level of protection as is required for other new buildings reduces flood losses and flood insurance claims;
- Requiring new construction in the coastal Zone A to meet the same standards as Zone V buildings protects it from a known, but unmapped, breaking wave hazard; and
- Adopting and enforcing construction rules tailored to special flood-related hazards, such as coastal erosion and alluvial fan flooding, provides protection in ways that the NFIP's national minimum criteria cannot do.

Stormwater Management, CRS Activity 450, provides CRS credits to communities that use one of the following four approaches to stormwater management: (1) regulating each activity to ensure peak flow runoff from a project site does not increase from the project's baseline before development; (2) regulating development according to a watershed master plan that analyzes the combined effects of existing and expected development on drainage throughout the watershed; (3) controlling erosion and sediment to protect nearby watersheds; (4) requiring new development to be elevated above the BFE; and (5) requiring new developments' stormwater management facilities to improve the quality of stormwater runoff (FEMA, 2013b). The objective of this activity is to prevent future development from increasing flood hazards to existing development and to maintain and improve water quality. When unmanaged, stormwater runoff from new development throughout a watershed can affect floodplains by causing more frequent flooding, greater flood depths, and longer-lasting floods. As forests, fields, and farms are covered by impermeable surfaces, such as streets, rooftops, and parking lots, more of the rain runs off and it runs off at a faster rate. When an area is urbanized, the rate of runoff and the volume of runoff can increase five-fold or more.

Adequate stormwater management planning and investments support a community's use of deliberate land use planning to influence development patterns in a community. Typically, new development introduces new stormwater runoff patterns, but these can be managed as a component of land use planning to allow for the proper balance of use between developed areas with urbanizing characteristics and less urban areas suitable for less intense development.

It is very important to regulate new development to ensure that the peak flow and volume of stormwater runoff leaving a development site will be no greater than the runoff from the site before it was developed. Restrictions on individual developments can address many watershed development problems, but to prevent unwanted consequences from development as a whole, communities should plan on a watershed-wide basis.

By completing watershed master plans as part of a community's land use and planning efforts, communities can examine the potential impact of unmitigated development on streams and structures throughout the watershed. Once these impacts are known, a comprehensive program, including more specific development regulations, can be created to prevent adverse impacts. This will prevent an increase in flood damage or stream erosion, reductions in groundwater recharge or water quality, and loss of habitat.

Floodplain Management Planning, CRS Activity 510, provides CRS credit for implementing one of the following types of plans:

- Floodplain Management Planning (FMP): The most credit is for the first element, a community-wide floodplain management plan, but the element can also credit multi-hazard mitigation plans, multi-jurisdictional floodplain management and hazard mitigation plans, and floodplain management plans prepared for the United States Army Corps of Engineers (USACE).
- Repetitive Loss Area Analyses: The second element credits more detailed, site-specific plans to reduce flood losses in repetitively flooded areas. It has a narrower scope than a floodplain management plan and receives fewer credit points.
- Natural Floodplain Functions Plan: The third element provides credit for plans that address natural floodplain functions in the community.

This activity credit was designed around the well-proven framework seen in comprehensive planning that depends upon land use authorities to implement comprehensive plans. The objective of this activity is to credit the production of an overall strategy of programs, projects, and measures that will reduce the adverse impact of the hazard on the community and help meet other community needs. This activity was developed to address the problem that flood protection decisions are often made quickly, with inadequate or outdated information or without considering all possible mitigation alternatives or the consequences of those alternatives. As a result, the community's resources are not allocated most appropriately, flood problems may not be fully addressed, and natural floodplain functions may suffer.

To remedy this situation, a careful, systematic process of planning is required in order to be credited under this activity category. The CRS does not specify what activities a plan must recommend. Rather, it recognizes plans that have been prepared according to the standard planning process explained in this activity. The CRS Floodplain Management Planning credit is based upon a prescribed 10-step process that includes public input, the development of recommendations, and community leadership endorsement leading to implementation.

Acquisition and Relocation (CRS Activity 520) and Flood Protection (CRS Activity 530) are two CRS activities that steer community leaders to making specific choices about land use depending upon the flood risk severity and recurrence of flood damage. Under CRS Activity 520, communities may choose to acquire and relocate buildings that have experienced, or are subject to, severe flood damage in exchange for CRS credit. Notably, credit is only provided if the community can document that the land, or the portion of the land within the regulatory floodplain, will remain vacant.

Conversely, under CRS Activity 530, communities may have locations with improvements and infrastructure where the existing use is desired to continue. Under these circumstances, a community may undertake the following measures to reduce the flood risk to such properties in exchange for CRS credit:

- Retrofitting the buildings so that they suffer no or minimal damage when flooded; and/or
- Constructing small flood control projects that reduce the risk of flood waters reaching the buildings.

In both of these instances—Acquisition/Relocation and Flood Protection—community leaders direct land use in flood prone areas. In one case, community leaders may determine the best land use is to relocate people and property away from the flood hazard through acquisition and relocation. In another case, they may determine the best land use is to continue use of the land, but with additional flood protection systems in place.

Table 3-3 shows the number and percent of CRS communities receiving credit for activities to improve their CRS rating and Table 3-4 shows the same data by State. The activities listed in the tables are only a portion of the activities for which communities can receive credit. The activities listed in Table 3-3 and Table 3-4 are those activities most relevant to land use planning. The content that follows in Section 3.4.5, Existing Conditions—Nationwide Summary, provides an overview of the CRS communities within each State, their CRS Class rating, and number and percent of CRS communities receiving credit by region. Each State may have a variety of communities with different CRS Class ratings depending on the number and types of CRS credits implemented within each State.

Table 3-3: CRS Communities Receiving Credit for Land Use and Planning-Related Activities (shown by Activity and Element, 2016)

Series	Activity	Number of Communities Receiving Credit	Percent of Communities Receiving Credit
420	Open Space Preservation	1,254	89%
430	Higher Regulatory Standards	1,413	100%
450	Stormwater Management	1,283	91%
510	Floodplain Management Planning	849	60%
520	Acquisition and Relocation	360	25%
530	Flood Protection	182	13%

Source: (FIMA, 2016)

Table 3-4: NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities by State, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	**Total No. of Communities**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
AL	**15**	15	100%	15	100%	13	87%	7	47%	8	53%	2	13%	12	80%
AK	**6**	6	100%	6	100%	2	33%	3	50%	1	17%	0	0%	1	17%
AZ	**26**	21	81%	26	100%	26	100%	15	58%	8	31%	1	4%	22	85%
AR	**16**	11	69%	15	94%	11	69%	6	38%	2	13%	0	0%	11	69%
CA	**92**	83	90%	92	100%	88	96%	34	37%	13	14%	12	13%	81	88%
CO	**47**	43	91%	47	100%	45	96%	13	28%	5	11%	2	4%	37	79%
CT	**8**	7	88%	8	100%	8	100%	6	75%	2	25%	0	0%	2	25%
DE	**11**	10	91%	11	100%	9	82%	5	45%	1	9%	2	18%	7	64%
FL	**230**	223	97%	230	100%	227	99%	195	85%	45	20%	47	20%	199	87%
GA	**52**	42	81%	52	100%	52	100%	25	48%	16	31%	1	2%	26	50%
HI	**2**	1	50%	2	100%	2	100%	2	100%	0	0%	0	0%	0	0%
ID	**20**	20	100%	20	100%	16	80%	10	50%	3	15%	3	15%	9	45%
IL	**62**	60	97%	62	100%	56	90%	35	56%	25	40%	11	18%	28	45%
IN	**32**	20	63%	32	100%	17	53%	14	44%	6	19%	1	3%	1	3%
IA	**8**	7	88%	8	100%	8	100%	7	88%	8	100%	1	13%	3	38%
KS	**32**	24	75%	31	97%	23	72%	21	66%	8	25%	1	3%	14	44%
KY	**27**	16	59%	26	96%	14	52%	13	48%	4	15%	1	4%	9	33%
LA	**42**	39	93%	42	100%	34	81%	39	93%	20	48%	11	26%	39	93%
ME	**17**	17	100%	17	100%	13	76%	0	0%	2	12%	0	0%	2	12%
MD	**14**	14	100%	14	100%	14	100%	9	64%	6	43%	4	29%	4	29%
MA	**16**	14	88%	16	100%	15	94%	9	56%	3	19%	1	6%	5	31%
MI	**21**	19	90%	21	100%	17	81%	3	14%	3	14%	2	10%	14	67%
MN	**8**	6	75%	8	100%	6	75%	3	38%	7	88%	1	13%	3	38%
MS	**32**	24	75%	32	100%	28	88%	24	75%	13	41%	4	13%	24	75%
MO	**8**	7	88%	8	100%	7	88%	6	75%	5	63%	1	13%	3	38%
MT	**12**	10	83%	12	100%	6	50%	4	33%	0	0%	0	0%	4	33%

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
NE	6	6	100%	6	100%	5	83%	4	67%	1	17%	0	0%	3	50%
NV	10	10	100%	10	100%	10	100%	7	70%	1	10%	1	10%	9	90%
NH	4	4	100%	4	100%	2	50%	1	25%	1	25%	0	0%	1	25%
NJ	81	80	99%	81	100%	81	100%	61	75%	11	14%	22	27%	39	48%
NM	11	10	91%	11	100%	9	82%	2	18%	2	18%	1	9%	10	91%
NY	36	32	89%	36	100%	33	92%	20	56%	4	11%	1	3%	14	39%
NC	86	69	80%	86	100%	84	98%	55	64%	25	29%	5	6%	77	90%
ND	3	3	100%	3	100%	2	67%	1	33%	3	100%	0	0%	2	67%
OH	13	13	100%	13	100%	12	92%	5	38%	6	46%	0	0%	5	38%
OK	12	9	75%	12	100%	11	92%	8	67%	5	42%	2	17%	10	83%
OR	27	26	96%	27	100%	23	85%	15	56%	4	15%	6	22%	20	74%
PA	28	25	89%	28	100%	27	96%	15	54%	6	21%	1	4%	15	54%
PR	1	0	0%	1	100%	1	100%	1	100%	1	100%	0	0%	0	0%
RI	9	9	100%	9	100%	9	100%	6	67%	2	22%	1	11%	4	44%
SC	44	37	84%	44	100%	43	98%	28	64%	3	7%	2	5%	29	66%
SD	5	2	40%	5	100%	2	40%	1	20%	1	20%	0	0%	1	20%
TN	14	6	43%	14	100%	11	79%	8	57%	4	29%	0	0%	6	43%
TX	62	56	90%	62	100%	59	95%	40	65%	25	40%	5	8%	50	81%
UT	11	8	73%	11	100%	10	91%	0	0%	0	0%	0	0%	8	73%
VT	6	6	100%	6	100%	6	100%	4	67%	1	17%	0	0%	3	50%
VA	25	24	96%	25	100%	24	96%	15	60%	7	28%	4	16%	12	48%
WA	35	33	94%	35	100%	35	100%	27	77%	17	49%	19	54%	21	60%
WV	10	8	80%	10	100%	8	80%	10	100%	7	70%	2	20%	3	30%
WI	17	17	100%	17	100%	17	100%	5	29%	7	41%	1	6%	7	41%
WY	4	2	50%	4	100%	2	50%	2	50%	2	50%	0	0%	2	50%
Total	1416	1254	89%	1413	100%	1283	91%	849	60%	360	25%	182	13%	911	64%

Source: (FIMA, 2016)

3.4.5 Existing Conditions—Nationwide Summary

3.4.5.1 FEMA Region I

3.4.5.1.1 Land Use and Land Cover

Region I covers Maine, Vermont, New Hampshire, Massachusetts, Connecticut, and Rhode Island and contains the northern portion of the "northeast megalopolis," a highly urbanized area stretching from the northern suburbs of Boston south to the southern suburbs of Washington, DC. The region is home to several major metropolitan areas along the I-95 corridor, including Boston, MA; Providence, RI; Hartford, CT; and the greater metropolitan area of New York City, which extends into Connecticut. These metropolitan areas are characterized by a densely developed urban core that disperses to a network of surrounding suburbs, villages, and hamlets that are developed at lower densities. The Boston and Providence metropolitan regions are ranked among the least sprawling metro areas in the country and have strong, established urban cores, whereas Hartford and Bridgeport, CT are among the most sprawling areas (Ewing, Pendall, & Chen, 2002). The northern portion of Region I is more rural in character, with lower density development and a higher percentage of forest cover and agricultural activities.

3.4.5.1.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 60 communities participate in the CRS in Region I as shown in Table 3-5. All 60 communities participate in the higher regulatory standards activity and 95 percent participate in the open space preservation activity. Only 2 of the 60 communities participate in the flood protection activity.

Table 3-5: FEMA Region I NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
CT	8	7	88%	8	100%	8	100%	6	75%	2	25%	0	0%	2	25%
ME	17	17	100%	17	100%	13	76%	0	0%	2	12%	0	0%	2	12%
MA	16	14	88%	16	100%	15	94%	9	56%	3	19%	1	6%	5	31%
NH	4	4	100%	4	100%	2	50%	1	25%	1	25%	0	0%	1	25%
RI	9	9	100%	9	100%	9	100%	6	67%	2	22%	1	11%	4	44%
VT	6	6	100%	6	100%	6	100%	4	67%	1	17%	0	0%	3	50%
Total	60	57	95%	60	100%	53	88%	26	43%	11	18%	2	3%	17	28%

Source: (FIMA, 2016)

3.4.5.2 FEMA Region II

3.4.5.2.1 Land Use and Land Cover

Region II covers New York, New Jersey, Puerto Rico, and the United States Virgin Islands (USVI). There is wide diversity of land use within Region II, which contains some of the most densely developed urban land in the country in and around New York City, NY, and Jersey City, NJ. Smart Growth America's (SGA) 2002 survey ranked these two cities as the two least sprawling cities. Elsewhere in the region, villages, towns, and other small communities give way to rural agricultural communities. Other urban centers such as Buffalo and Rochester, NY, have significant urbanization and development, although they are more isolated from other populous areas in the country. Buffalo is ranked as a less sprawling city, while Rochester is among the most sprawling (Ewing, Pendall, & Chen, 2002). Southern New Jersey and upstate New York have prevalent agricultural land uses and more rural, with upstate New York containing significant forest cover. Region II includes the USVI and Puerto Rico; no cities from the USVI or Puerto Rico were included in the SGA report on urban sprawl.

3.4.5.2.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 118 communities participate in the CRS in Region II as shown in Table 3-6. All 118 communities participate in the higher regulatory standards activity and 97 percent participate in the stormwater management activity. Only 16 of the 118 communities participate in the acquisition and relocation activity.

Table 3-6: FEMA Region II NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
NJ	81	80	99%	81	100%	81	100%	61	75%	11	14%	22	27%	39	48%
NY	36	32	89%	36	100%	33	92%	20	56%	4	11%	1	3%	14	39%
PR	1	0	0%	1	100%	1	100%	1	100%	1	100%	0	0%	0	0%
Total	118	112	95%	118	100%	115	97%	82	69%	16	14%	23	19%	53	45%

Source: (FIMA, 2016)

3.4.5.3 FEMA Region III

3.4.5.3.1 Land Use and Land Cover

Region III covers Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and DC, and contains the southernmost portion of the northeast megalopolis. As with Regions I and II, this region contains several major urban areas, including Washington, DC; Baltimore, MD; Norfolk/Virginia Beach, VA; Philadelphia, PA; and Pittsburgh, PA. Washington, DC and Norfolk, VA are both somewhat more sprawling than the median. However, older cities, such as Philadelphia and Baltimore were ranked among the least sprawling (Ewing, Pendall, & Chen, 2002). The region is a mix of uses, with a strong agricultural presence and deciduous forest cover outside of the urban areas, in addition to lands used for mining and other extraction processes. Lancaster County, PA is one of the few municipalities in the country that maintains a strict Urban Growth Boundary combined with strong agricultural zoning requirements (Greenbelt Alliance, 2012).

3.4.5.3.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 88 communities participate in the CRS in Region III as shown in Table 3-7. All 88 communities participate in the higher regulatory standards activity, 93 percent participate in the stormwater management activity, and 92 percent participate in the open space preservation activity. Only 13 of the 88 communities participate in the flood protection activity.

Table 3-7: FEMA Region III NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
DE	11	10	91%	11	100%	9	82%	5	45%	1	9%	2	18%	7	64%
MD	14	14	100%	14	100%	14	100%	9	64%	6	43%	4	29%	4	29%
PA	28	25	89%	28	100%	27	96%	15	54%	6	21%	1	4%	15	54%
VA	25	24	96%	25	100%	24	96%	15	60%	7	28%	4	16%	12	48%
WV	10	8	80%	10	100%	8	80%	10	100%	7	70%	2	20%	3	30%
Total	88	81	92%	88	100%	82	93%	54	61%	27	31%	13	15%	41	47%

Source: (FIMA, 2016)

3.4.5.4 FEMA Region IV

3.4.5.4.1 Land Use and Land Cover

Region IV includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. The area is more rural in character than the Northeast; however, there are several major urban centers, including Atlanta, GA; Memphis, TN; Tampa, FL; Columbia, SC; Charlotte, NC; and Miami, FL. Of those cities in Region IV that were analyzed in the SGA study, all were more sprawling than average, with cities such as Winston-Salem, NC; Raleigh-Durham, NC; and Atlanta, GA, ranking 2nd, 3rd, and 4th, respectively, in terms of sprawl of the 83 cities evaluated (Ewing, Pendall, & Chen, 2002). The area contains a range of land uses; there is little high density development outside of the major cities and most suburban development is low- and medium-density residential, with segregated commercial and industrial facilities and areas of agricultural use.

3.4.5.4.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 500 communities participate in the CRS in Region IV as shown in Table 3-8. All but one of the communities participate in the higher regulatory standards activity and 94 percent participate in the stormwater management activity. Only 62 of the 500 communities participate in the flood protection activity.

Table 3-8: FEMA Region IV NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	**Total No. of Communities**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
AL	**15**	15	100%	15	100%	13	87%	7	47%	8	53%	2	13%	12	80%
FL	**230**	223	97%	230	100%	227	99%	195	85%	45	20%	47	20%	199	87%
GA	**52**	42	81%	52	100%	52	100%	25	48%	16	31%	1	2%	26	50%
KY	**27**	16	59%	26	96%	14	52%	13	48%	4	15%	1	4%	9	33%
MS	**32**	24	75%	32	100%	28	88%	24	75%	13	41%	4	13%	24	75%
NC	**86**	69	80%	86	100%	84	98%	55	64%	25	29%	5	6%	77	90%
SC	**44**	37	84%	44	100%	43	98%	28	64%	3	7%	2	5%	29	66%
TN	**14**	6	43%	14	100%	11	79%	8	57%	4	29%	0	0%	6	43%
Total	**500**	**432**	**86%**	**499**	**100%**	**472**	**94%**	**355**	**71%**	**118**	**24%**	**62**	**12%**	**382**	**76%**

Source: (FIMA, 2016)

3.4.5.5 FEMA Region V

3.4.5.5.1 Land Use and Land Cover

Region V covers Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. There are several major cities in the Region, including Chicago, IL; Minneapolis-St. Paul, MN; Detroit, MI; Indianapolis, IN; Milwaukee, WI; and Columbus, OH. The area is known for both agriculture and manufacturing, and has a wide range of land uses. Chicago and Milwaukee are both relatively old, densely built cities with a strong urban core, whereas Columbus, Minneapolis-St. Paul, and Indianapolis were all rated as slightly more sprawling. Detroit, which has undergone tremendous stress in recent years due to de-urbanization and the impacts of the economic crisis, rates as one of the most sprawling cities in the region (Ewing, Pendall, & Chen, 2002). There are large areas of crop agriculture observed in the lower portion of the region, as well as undisturbed areas containing wetlands and forests in the northern portion.

3.4.5.5.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 153 communities participate in the CRS in Region V as shown in Table 3-9. All 153 communities participate in the higher regulatory standards activity and 88 percent participate in the open space preservation activity. Only 16 of the 153 communities participate in the flood protection activity.

Table 3-9: FEMA Region V NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
IL	62	60	97%	62	100%	56	90%	35	56%	25	40%	11	18%	28	45%
IN	32	20	63%	32	100%	17	53%	14	44%	6	19%	1	3%	1	3%
MI	21	19	90%	21	100%	17	81%	3	14%	3	14%	2	10%	14	67%
MN	8	6	75%	8	100%	6	75%	3	38%	7	88%	1	13%	3	38%
OH	13	13	100%	13	100%	12	92%	5	38%	6	46%	0	0%	5	38%
WI	17	17	100%	17	100%	17	100%	5	29%	7	41%	1	6%	7	41%
Total	153	135	88%	153	100%	125	82%	65	42%	54	35%	16	10%	58	38%

Source: (FIMA, 2016)

3.4.5.6 FEMA Region VI

3.4.5.6.1 Land Use and Land Cover

Region VI covers Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. Although the Region contains several very large, major metropolitan areas, such as Houston, Dallas, and San Antonio, TX; Albuquerque, NM; Tulsa, OK; New Orleans, LA; and Little Rock, AR, it is geographically diverse. The area is known for oil and gas development, cattle and agriculture, and tourism and over 80 tribes in the region. The region includes dense development in New Orleans; sprawling development in Dallas, Fort Worth, Houston, and Tulsa; and less developed areas extending into the Gulf of Mexico and across west Texas and into New Mexico.

3.4.5.6.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 143 communities participate in the CRS in Region VI as shown in Table 3-10. All but one of the communities participate in the higher regulatory standards activity and 87 percent participate in the open space preservation activity and the stormwater management activity. Only 19 of the 143 communities participate in the flood protection activity.

Table 3-10: FEMA Region VI NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	**Total No. of Communities**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
AR	**16**	11	69%	15	94%	11	69%	6	38%	2	13%	0	0%	11	69%
LA	**42**	39	93%	42	100%	34	81%	39	93%	20	48%	11	26%	39	93%
NM	**11**	10	91%	11	100%	9	82%	2	18%	2	18%	1	9%	10	91%
OK	**12**	9	75%	12	100%	11	92%	8	67%	5	42%	2	17%	10	83%
TX	**62**	56	90%	62	100%	59	95%	40	65%	25	40%	5	8%	50	81%
Total	**143**	**125**	**87%**	**142**	**99%**	**124**	**87%**	**95**	**66%**	**54**	**38%**	**19**	**13%**	**120**	**84%**

Source: (FIMA, 2016)

3.4.5.7 FEMA Region VII

3.4.5.7.1 Land Use and Land Cover

Region VII covers Iowa, Kansas, Missouri, and Nebraska. Although there are several major cities in the region, including St. Louis, MO, Kansas City, MO, Wichita, KS, Lincoln, NE, and Omaha, NE, it is primarily rural in nature with a significant agricultural presence and land used for row crops and pasture. St. Louis and Kansas City are slightly more sprawling than average, Wichita is slightly less sprawling than average, and Omaha is ranked as the 6th least sprawling city in the SGA survey (Ewing, Pendall, & Chen, 2002). Small, rural communities are prevalent and population density is low overall.

3.4.5.7.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 54 communities participate in the CRS in Region VII as shown in Table 3-11. All but one of the communities participate in the higher regulatory standards activity, 81 percent participate in the open space preservation activity, and 80 percent participate in the stormwater management activity. Only 3 of the 54 communities participate in the flood protection activity.

Table 3-11: FEMA Region VII NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	**Total No. of Communities**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
IA	**8**	7	88%	8	100%	8	100%	7	88%	8	100%	1	13%	3	38%
KS	**32**	24	75%	31	97%	23	72%	21	66%	8	25%	1	3%	14	44%
MO	**8**	7	88%	8	100%	7	88%	6	75%	5	63%	1	13%	3	38%
NE	**6**	6	100%	6	100%	5	83%	4	67%	1	17%	0	0%	3	50%
Total	**54**	**44**	**81%**	**53**	**98%**	**43**	**80%**	**38**	**70%**	**22**	**41%**	**3**	**6%**	**23**	**43%**

Source: (FIMA, 2016)

3.4.5.8 FEMA Region VIII

3.4.5.8.1 Land Use and Land Cover

Region VIII covers Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming. It is one of the least densely populated areas of the country, and is highly rural overall. There are a few major urban centers, including Denver and Boulder, CO; and Salt Lake City, UT, all of which are ranked as less sprawling cities according to the SGA study (Ewing, Pendall, & Chen, 2002). Much of the area is agricultural, with grasslands, rangelands, and row crops. Mining and other extraction-based industrial land uses are prevalent, and the region is largely defined by the presence of the Rocky Mountains and extensive public lands in the form of national parks and recreation areas.

3.4.5.8.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 82 communities participate in the CRS in Region VIII as shown in Table 3-12. All 82 communities participate in the higher regulatory standards activity, 83 percent participate in the open space preservation activity, and 82 percent participate in the stormwater management activity. Only 2 of the 82 communities participate in the flood protection activity.

Table 3-12: FEMA Region VIII NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	**Total No. of Communities**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
CO	**47**	43	91%	47	100%	45	96%	13	28%	5	11%	2	4%	37	79%
MT	**12**	10	83%	12	100%	6	50%	4	33%	0	0%	0	0%	4	33%
ND	**3**	3	100%	3	100%	2	67%	1	33%	3	100%	0	0%	2	67%
SD	**5**	2	40%	5	100%	2	40%	1	20%	1	20%	0	0%	1	20%
UT	**11**	8	73%	11	100%	10	91%	0	0%	0	0%	0	0%	8	73%
WY	**4**	2	50%	4	100%	2	50%	2	50%	2	50%	0	0%	2	50%
Total	**82**	**68**	**83%**	**82**	**100%**	**67**	**82%**	**21**	**26%**	**11**	**13%**	**2**	**2%**	**54**	**66%**

Source: (FIMA, 2016)

3.4.5.9 FEMA Region IX

3.4.5.9.1 Land Use and Land Cover

Region IX consists of Arizona, California, Hawaii, Nevada, and the Pacific Island territories. The region is highly diverse, with several large urban centers such as Phoenix, AZ; Los Angeles, San Diego, and San Francisco, CA; Honolulu, HI; and Las Vegas, NV. Although most of these major cities ranked near the median in the SGA study, San Francisco and Honolulu were ranked as the 4th and 5th least sprawling cities in the survey, respectively (Ewing, Pendall, & Chen, 2002). The continental portion of the region is punctuated by the Sierra Nevada mountain range, with large areas of public lands on either side; approximately 67 percent of Nevada's land base is owned by BLM (BLM, 2013). As a result, large tracts of undeveloped land are prevalent throughout Nevada, Arizona, and California, with uses consisting of mineral extraction, habitat, and recreation. Central California is characterized primarily by agricultural land, with heavier forest cover toward the northern part of the State. While there is a major concentration of developed urban land on Oahu, particularly in and around Honolulu, the Hawaiian Islands are not heavily developed overall. Agricultural land uses are prevalent on Kauai, Oahu, Maui, and Hawaii. Hawaii is focused heavily on tourism, so low- to moderate-density commercial development is found on all islands. The Pacific Island territories of Guam, the Northern Mariana Islands, and American Samoa are primarily rural in character, with low density residential and commercial development.

3.4.5.9.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 130 communities participate in the CRS in Region IX as shown in Table 3-13. All 130 communities participate in the higher regulatory standards activity and 88 percent participate in the open space preservation activity. Only 14 of the 130 communities participate in the flood protection activity.

Table 3-13: FEMA Region IX NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
AZ	26	21	81%	26	100%	26	100%	15	58%	8	31%	1	4%	22	85%
CA	92	83	90%	92	100%	88	96%	34	37%	13	14%	12	13%	81	88%
HI	2	1	50%	2	100%	2	100%	2	100%	0	0%	0	0%	0	0%
NV	10	10	100%	10	100%	10	100%	7	70%	1	10%	1	10%	9	90%
Total	130	115	88%	130	100%	126	97%	58	45%	22	17%	14	11%	112	86%

Source: (FIMA, 2016)

3.4.5.10 FEMA Region X

3.4.5.10.1 Land Use and Land Cover

Region X includes Alaska, Idaho, Oregon, and Washington. Although there are several major cities, including Seattle, WA; Portland, OR; and Anchorage, AK, the region has a low population density overall, and corresponding low development density. While Portland is ranked among the least sprawling cities by the SGA study, Seattle was ranked at the median, and Anchorage was not part of the study (Ewing, Pendall, & Chen, 2002). There are substantial public lands in all four States, as well as extensive forest cover, primarily evergreen. There is a large presence of agricultural lands along the Columbia River, extending up into eastern Washington. The northern part of Alaska includes extensive tracts of undeveloped land concentrated in the northern part of the State, such as the National Petroleum Preserve (22.8 million acres), Arctic National Wildlife Refuge (9 million acres), and Gates of the Arctic National Park and Preserve (8.47 million acres) (Alaska Public Lands Information Centers, 2016) (NPS, 2014b). The central and southern part of the State is characterized by very sparse development and large tracts of undeveloped land, such as the Denali National Park and Preserve (6 million acres), Koyukuk National Wildlife Refuge (15 million acres), Innoko National Wildlife Refuge (3.85 million acres), and Tongass National Forest (17 million acres) (NPS, 2014b) (USFWS, 2015b) (Audubon Alaska, 2016).

3.4.5.10.2 Planning and CRS

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities and land use practices that exceed the minimum NFIP requirements. A total of 88 communities participate in the CRS in Region X as shown in Table 3-14. All 88 communities participate in the higher regulatory standards activity and 97 percent participate in the open space preservation activity. Twenty-five of the 88 communities participate in the acquisition and relocation activity.

Table 3-14: FEMA Region X NFIP Communities Receiving CRS Credit for Land Use and Planning Related Activities, 2016

		OPEN SPACE PRESERVATION		HIGHER REGULATORY STANDARDS		STORMWATER MANAGEMENT		FLOODPLAIN MANAGEMENT PLANNING		ACQUISITION AND RELOCATION		FLOOD PROTECTION		DRAINAGE SYSTEM MAINTENANCE	
State	Total No. of Communities	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
AK	6	6	100%	6	100%	2	33%	3	50%	1	17%	0	0%	1	17%
ID	20	20	100%	20	100%	16	80%	10	50%	3	15%	3	15%	9	45%
OR	27	26	96%	27	100%	23	85%	15	56%	4	15%	6	22%	20	74%
WA	35	33	94%	35	100%	35	100%	27	77%	17	49%	19	54%	21	60%
Total	88	85	97%	88	100%	76	86%	55	63%	25	28%	28	32%	51	58%

Source: (FIMA, 2016)

3.5 GEOLOGY AND SOILS

Unit of Analysis
USGS Physiographic Regions

3.5.1 Definition of the Resource

The USGS is the primary government organization responsible for researching and providing scientific information on the nation's geological resources for use by resource managers, planners, and others. USGS defines geology as an interdisciplinary science, with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability. Several of these elements are discussed in other sections of this NPEIS; including groundwater (Section 3.6), biological resources (Section 3.7), and climate change (Section 3.13).

This section covers aspects of geology and soils that are most relevant to the NFIP and floodplains: geologic hazards, soils, and physiographic regions. Development and human activity in the floodplain vary throughout the country depending on local geologic conditions. The unit of analysis for this section, USGS Physiographic Regions,[21] was selected to group geology and soil resources by geographic areas that possess similar geologic/physical characteristics. Refer to Section 3.1.2 for a more detailed discussion of USGS Physiographic Regions.

3.5.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. There are no nationwide geology or soil laws or regulations that are directly applicable to the NFIP.

3.5.3 Existing Conditions—Nationwide Geologic Hazards

The major geologic hazards that persist throughout the country relevant to the NFIP are landslides/erosion and subsidence. A discussion of each of these geologic hazards, and their context as it relates to the NFIP, is included below.

3.5.3.1 Landslides/Erosion

The term "landslide" describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures. Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale. Landslides can be triggered by a single severe storm or earthquake, causing widespread damage in a short period. Landslide events can be triggered by water infiltration that decomposes and loosens rock and soil, lubricates frictional surfaces, adds weight to an incipient landslide, and imparts buoyancy to the individual particles. Intense rainfall, rapid snowmelt, freeze/thaw cycles, earthquakes, volcanic eruptions, and human alterations to the natural landscape can trigger mass land movements. Large landslides can dam rivers or streams, and cause both upstream and downstream flooding (Figure 3-7). (USGS, 2003a)

[21] Physiographic Regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).

Source: (USGS, 2012a)

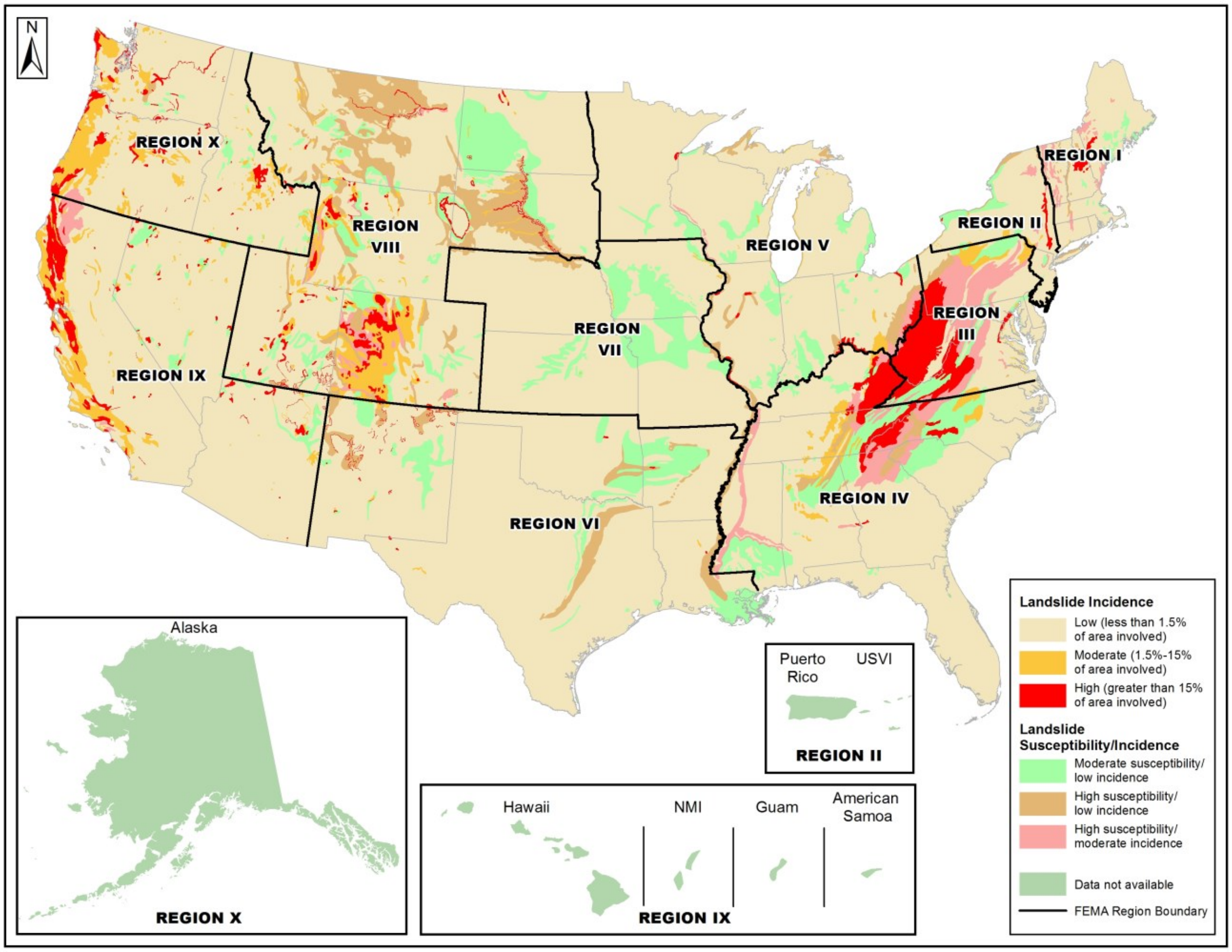
Figure 3-7. Washed Out Road Crossing – Atlanta, GA

Landslides occur nationwide and claim 25 to 50 lives a year. On an annual basis, total economic damages typically exceed $2B per year. Thirty-six States have moderate to highly severe landslide hazards (USGS, 2003a). The greatest widespread landslide damage and risk occurs in the Appalachian, Rocky Mountain, and Pacific Coast regions and Puerto Rico. Seismically active mountainous regions, such as those in Alaska, Hawaii, and the West Coast are especially at risk. Areas where wildfires have removed vegetation and exposed barren ground to heavy rainfall are vulnerable as well. Landslide losses are rising in the United States as development expands in landslide-prone regions. Continued encroachment of developments into hazardous areas, expansion of transportation infrastructure, deforestation of landslide-prone areas, and changing climate patterns are expected to lead to continually increasing landslide losses (Godt, 2012). Figure 3-8 depicts the landslide susceptibility for the lower 48 states (data not available for Alaska, Hawaii, and the territories).

Landslide events are somewhat predicated on the occurrence of another event (e.g., heavy rainfall, earthquake, etc.) (Godt, 2012). Of the 18 most damaging landslides, in terms of cost and fatalities, to occur in the United States between 1906 and 1998, the majority (13) affected the Pacific Coast Region (USGS, Undated). During July 2014, USGS documented landslides in Maine, Florida, Iowa, Minnesota, Wyoming, Utah, Colorado, Arizona, Nevada, and Washington (USGS, 2014a). Several high-profile landslide examples are discussed in Section 3.5.5.

3.5.3.1.1 Landslide Dams

Landslide dams frequently form where narrow steep valleys are bordered by high rugged mountains. The most common initiation mechanisms for dam-forming landslides are earthquakes and excessive rainfall and snowmelt. Natural dams may cause upstream flooding as lakes rise, and downstream flooding when dams fail. Many landslide dams fail shortly after formation. In one study of 73 documented landslide-dam failures, 27 percent of the landslide dams failed less than 1 day after formation, and about 50 percent failed within 10 days. Overtopping is by far the most common cause of failure. Failure of landslide dams can result in major downstream flooding and loss of life (Costa & Schuster, 1987).



Source: (National Atlas of the United States, 2001) (Radbruch-Hall, et al., 1982)

Figure 3-8: United States Landslide Incidence and Susceptibility Hazard Map[22]

Landslide dam failures can pose a significant risk to human life and interests. In June 1925, a 38 million cubic-yard slide dammed the Gros Ventre River in northwest Wyoming. In 1927, the landslide dam failed, and flooding destroyed the small town of Kelly, WY. Six people drowned in the floodwaters (USGS, Undated). More recently, following a March 2014 landslide in Snohomish County, WA, portions of the North Fork Stillaguamish River pooled behind a debris dam, flooding several houses and other structures (Figure 3-9) (USGS, 2014b). Riverside residents between the slide area and Arlington, 15 miles to the west, were advised to leave their homes for the night, because of the danger that the North

[22] Susceptibility not indicated where same or lower than incidence. Susceptibility to landsliding was defined as the probable degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated.

Fork of the Stillaguamish River could burst through the blockage and cause immediate, severe flooding (Gonzalez, Garnick, & Broom, 2014). Fortunately, the dam did not fail.

Source: (USGS, 2014b)

Figure 3-9. Snohomish County Landslide (March 2014)

3.5.3.1.2 Stream Erosion

Frequent flooding in urban streams increases channel and bank erosion. Urban development can increase erosion rates in two ways: (1) the percentage of sand and silt in streambeds increases with greater levels of urban development; and (2) channel depth or cross-sectional areas have been shown to increase with greater levels of urban development (USGS, 2012a). Where channels have been straightened and vegetation has been removed from channel banks, streamflow velocities increase, allowing a stream to transport more sediment. In many urban areas, stream-bank erosion can threaten roads, bridges, and other structures that is difficult to control even by hardening stream banks (USGS, 2014c).

3.5.3.2 Subsidence

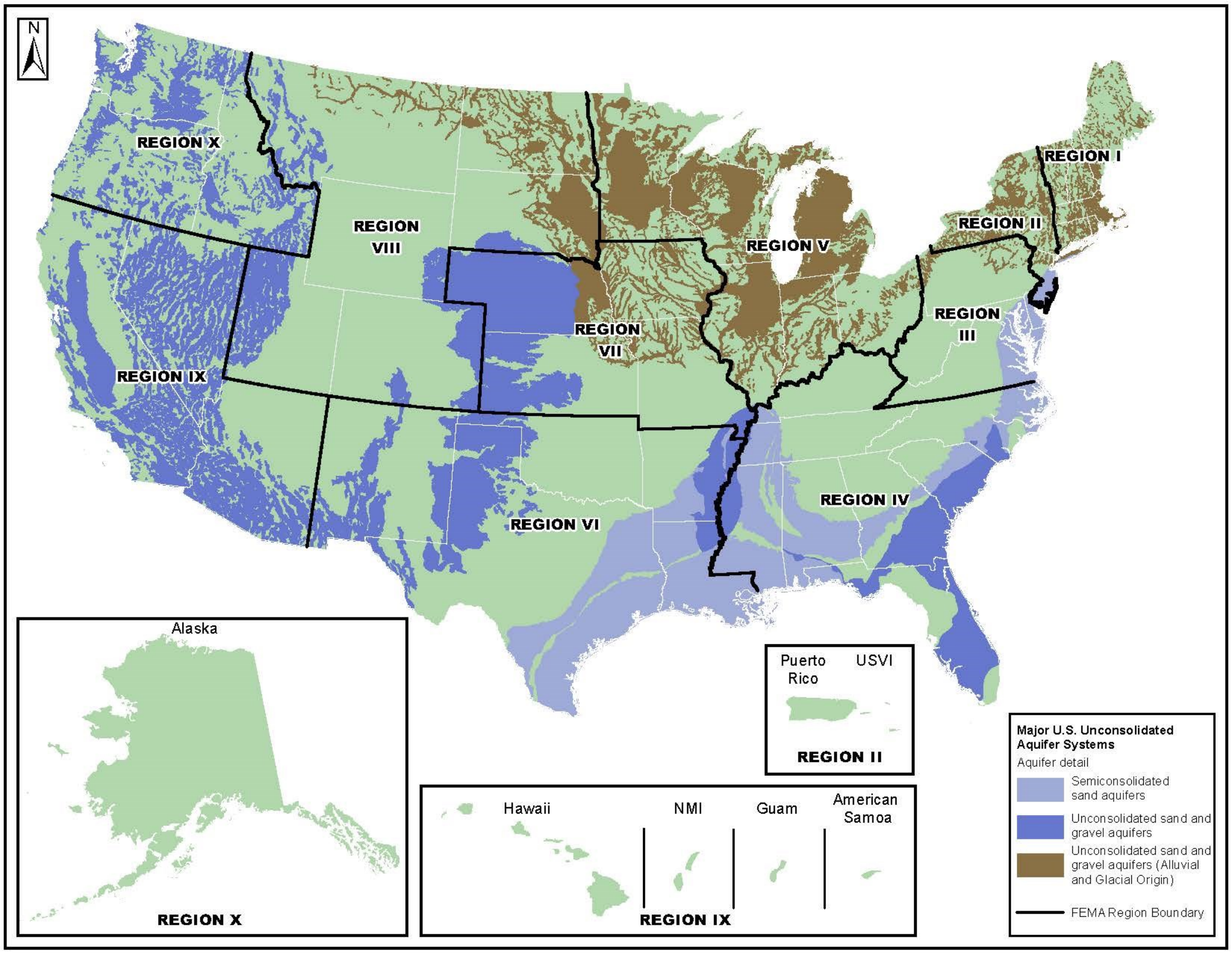
Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." The main triggers of land subsidence can be aquifer system compaction, karst topography,[23] drainage of organic soils, underground mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If layers of silt or clay, which do not transport groundwater, confine an aquifer, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds,

[23] Karst Topography: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater" (USGS, 2015c).

causing them to collapse on one another. The effects of this compression are seen in the lowering of the land surface elevation, which is permanent. (USGS, 2000)

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Lowered terrain is more susceptible to inundation during high tides. Changes in ground-surface elevation not only affect the integrity and operation of existing infrastructure, but also complicate vegetation and best management of land use (USGS, 2013c). In addition, land subsidence places an additional burden on FEMA to update Flood Insurance Rate Maps (FIRMs) to reflect changed conditions.

Subsidence has been observed in 45 States over more than 17,000 square miles (USGS, 2013d). Subsidence rates vary by site due to soil and geological composition, terrain, and rate of groundwater loss. Groundwater withdrawals can produce a range of measureable elevation decreases from roughly several millimeters a year to several meters per year. Some sinkholes can result in subsidence of several meters nearly instantaneously (Bouwer, Undated). In aquifer systems that include semi-consolidated silt and clay layers, long-term groundwater level declines can result in permanent compaction of the aquifer as sediments collapse on one another and pore space volume is reduced (USGS, 2000). Figure 3-10 depicts unconsolidated aquifers in the nation that are susceptible to subsidence due to aquifer compaction. Examples of subsidence are discussed in Section 3.5.5.



Source: (National Atlas of the United States, 2003)

Figure 3-10: USGS Map of Areas Susceptible to Subsidence due to Aquifer Compaction

3.5.4 Existing Conditions—Nationwide Soils

Soil is the natural medium for the growth of land plants (University of Idaho, Undated). Soil, which contains mineral matter, organic matter, water, and air, covers the earth's surface as a continuum, except on bare rock, in areas of perpetual frost or deep water, or on the bare ice of glaciers. The upper limit of soil is the boundary between soil and air, shallow water, live plants, or plant materials that have not begun to decompose. For purposes of classification, the lower boundary of soil is arbitrarily set at 200 cm (U.S. Department of Agriculture, 1999).

During the wet season in parts of the United States, especially in the Midwest, upland soils are often under water for days or weeks, causing oxygen depletion, which may in turn affect the chemistry of the soil-water system and, consequently, soil aggregation. Loss of soil aggregation in floodplains impacts agriculture by decreasing soil quality and crop production. Research revealed that the stability of upland soils was decreased from short-term water ponding. The decrease in aggregate stability reached approximately 20 percent during a 14-day ponding period. (Science Daily, 2009)

3.5.4.1 Soil Formation

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type seen in a particular area (University of Minnesota, 2001):

1. Parent Material: The geologic source material from which the soil was originally formed affects soil aspects, including color, texture, and ability to hold water.
2. Climate: Chemical changes in parent material proceed very slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.
3. Topography: Steeper slopes contribute to greater runoff, and, therefore, increased movement of soils downslope. Slope direction also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others do.
4. Biology: The presence of vegetation in soils increases the organic content of the soil.
5. Time: Soil properties are dependent on the period over which other processes act on them.

3.5.4.2 Soil Classification

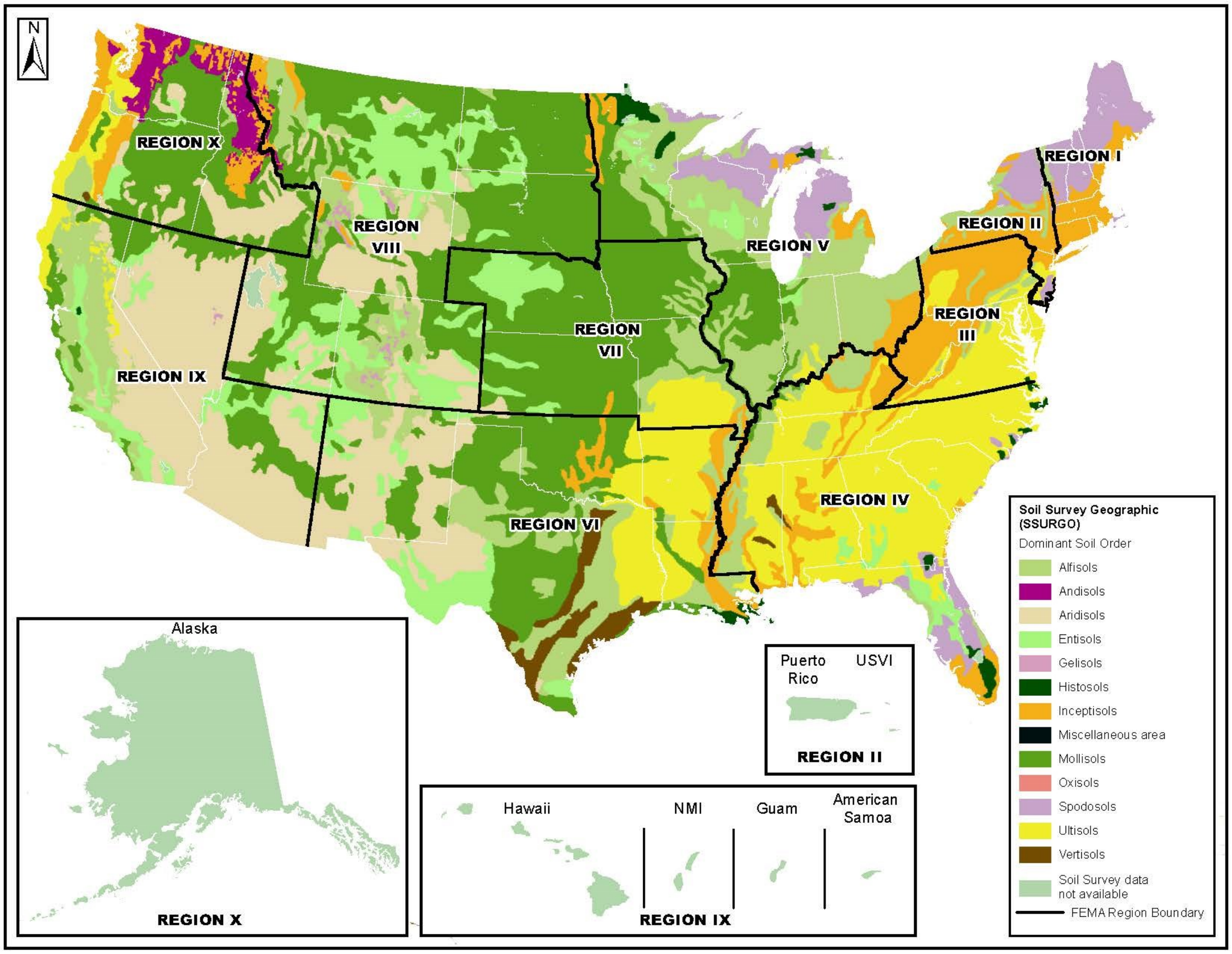
Soils are classified through a methodology referred to as a soil survey. Groupings are largely based on component materials or layers, which are a function of: parent material, climate, and presence of organisms (University of Idaho, Undated). A generalized map of each soil's coverage throughout the United States is included in Figure 3-11.

3.5.4.3 Prime Farmland

Prime farmland describes available lands that have the best physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if treated and managed according to acceptable farming methods. Prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods, and it either does not flood frequently during the growing season or is protected from flooding (Department of the Interior, Undated). Prime farmland in the nation (as of 1997) is displayed in Figure 3-12. As of that time, there were approximately 331.9 million acres of prime farmland nationwide, accounting for roughly 14.4 percent of the total land area.

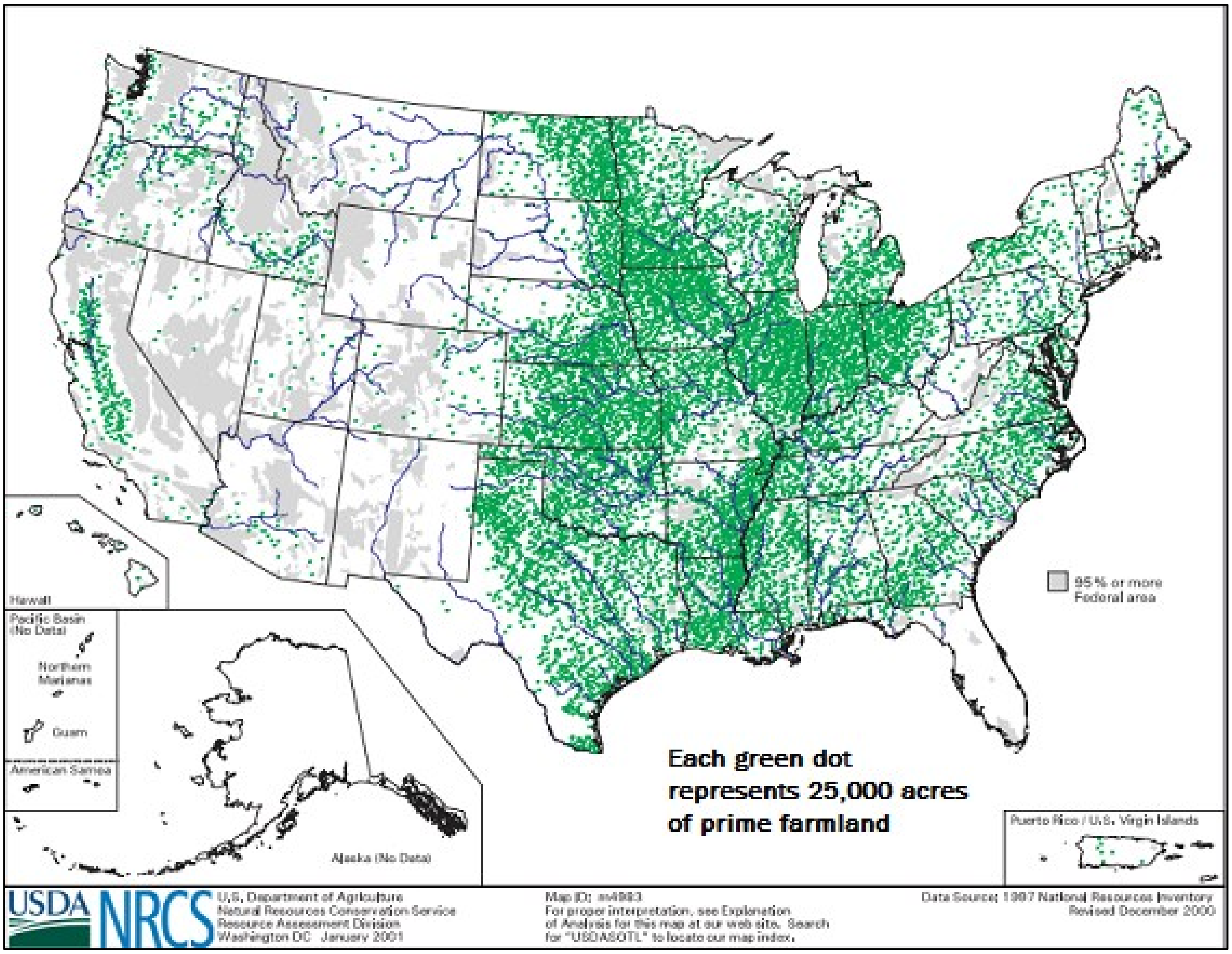
Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary of Agriculture. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables. (U.S. Department of Agriculture, 2012)

Farmland that is of statewide or local importance is used for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate State or unit of local government agency, with the approval of the Secretary of Agriculture. (U.S. Department of Agriculture, 2012)



Source: (U.S. Department of Agriculture, 2010)

Figure 3-11: Soil Survey Map



Source: (U.S. Department of Agriculture, 2000)

Figure 3-12: United States Prime Farmland Map (1997)

3.5.5 Existing Conditions—Nationwide Physiographic Regions

Geology and soils are inherently location-specific resources, and as such, existing conditions cannot be described in detail on a national scale in this document. However, it is possible to describe the general geologic composition of the States, territories, and DC with a discussion of physiographic regions, as established by USGS.

Physiographic regions are established by common geomorphology, rock type, and geologic structure and history. Geologic, topographic, and soil characteristics may impose limitations on potential uses for a particular site. Areas characterized by seismic activity, structural instability, excessive erodibility, steep slopes, or prime or unique farmlands, may completely preclude the implementation of a project at a particular site, require the use of certain engineering technology, or require consultation with State or Federal agencies.

The United States has eight distinct physiographic regions, with United States territories accounted for separately. These regions are further subdivided into 25 provinces, each with unique topography and geology. The eight major physiographic regions in the nation are the Laurentian Upland, Atlantic Plain, Appalachian Highlands, Interior Plains, Interior Highlands, Rocky Mountain System, Intermontane Plateaus, and the Pacific Mountain System (USGS, 2013a) (USGS, 2003b). Figure 3-2 shows the geographic distribution of each physiographic region.

3.5.5.1 Laurentian Upland

The Laurentian Upland Region includes portions of northern Michigan, Wisconsin, and Minnesota. The metamorphic rocks that contain the basement of the Laurentian Upland are the oldest on the continent; these rocks have been dated to 2.5 billion years old. Topographic relief is minimal throughout the region. "Hills rise just a few hundred feet above the surrounding countryside. The highest of these, such as Rib Hill, Wisconsin, are made up mostly of resistant quartzite or granite." (USGS, 2014d)

3.5.5.1.1 Earthquakes (Seismic Risk)

Earthquake risk within the Laurentian Upland is minimal (National Atlas of the United States, 2012a). For example, one of the lowest occurrence levels for earthquakes in the nation is in Minnesota. Similar to elsewhere in the Midwest, Minnesota's earthquakes are "attributed to minor reactivation of ancient (Precambrian) faults in response to modern stresses." (University of Minnesota -- Minnesota Geological Survey, 2014).

3.5.5.1.2 Landslides

The susceptibility of this region to landslides is relatively low. However, landslides may still occur on a localized basis, especially when triggered by risk factors such as heavy rains and/or loss of vegetation due to development or wildfires. For example, the highest potential for landslides in northern Michigan is found in areas "where Cambrian sandstone[24] or Ordovician and Silurian limestone[25] form cliffs along the shores of [Lake Michigan and Lake Superior]." Glacial deposits adjacent to both lakes also have demonstrated susceptibility to landslide events (Radbruch-Hall, et al., 1982).

3.5.5.1.3 Subsidence

Examples of subsidence are localized in the region and not considered significant for discussion on a regional scale (USGS, 2000).

3.5.5.2 Atlantic Plain

The Atlantic Plain Region includes the Continental Shelf and the Gulf and Atlantic Coast plains stretching from New York south to Florida and west to Texas. The Atlantic Plain Region formed through the repetitive rise and fall of the oceans over the last 150 million years. Sedimentary strata become thinner moving westward through the region, and thicken to several thousand feet thick along the coastline. Erosion from the Appalachian Mountains, which formed between 480 and 440 million years ago (MYA), dislodged sediments, which were subsequently deposited by rivers to form the Atlantic Plain.

[24] Sandstone: "Sedimentary rock made mostly of sand-sized grains" (USGS, 2015c).
[25] Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation" (USGS, 2015c).

This area is characterized by gentle topography and a transition zone between the land and sea, often having marshes, lagoons, swamps, sand bars, and reefs. (NPS, 2015a)

3.5.5.2.1 Earthquakes (Seismic Risk)

Portions of the Atlantic Plain are at risk for significant earthquakes. In September 1886, Charleston, SC experienced one of the most damaging earthquakes in the history of eastern North America (USGS, 2012b). This magnitude 7.3 earthquake was "felt over 2.5 million square miles, from Cuba to New York, and Bermuda to the Mississippi River" (South Carolina Emergency Management Division, 2012), and resulted in more than $5 million (M) in property damage, killed 60 people, and produced extensive cratering and fissuring across the ground surface (USGS, 2012b). An estimated 10 to 20 earthquakes occur within South Carolina annually, though most measure below magnitude 3.0 on the Richter scale (South Carolina Emergency Management Division, 2012). Most (70 percent) of South Carolina's earthquakes occur along the Middleton-Place Seismic Zone (South Carolina Emergency Management Division, 2015). The USGS earthquake probability prediction tool estimates that there is a 15 to 20 percent chance of a magnitude 6.0 earthquake occurring in the Charleston, SC,[26] area within the next 100 years (USGS, 2010). Elsewhere in the Atlantic Plain, earthquake risk is lower.

3.5.5.2.2 Landslides

The Atlantic Plain's susceptibility to widespread landslides is relatively low due to the Region's minimal topography. However, landslides may occur on a localized basis due to heavy rains, loss of vegetation, or wildfires (National Atlas of the United States, 2001). For example, Florida's only recorded landslide occurred in Gadsden County in 1948, when the unconsolidated sediments comprising the north-facing slope along Flat Creek flowed downhill toward the streambed. It was likely caused by rushing floodwaters from the creek below (Florida Department of Environmental Protection, 2014).

3.5.5.2.3 Subsidence

Regional subsidence is prevalent in the Atlantic Plain due to sediment compaction. Subsidence rates in Delaware and North Carolina are estimated at 1.7 millimeters (mm) per year and approximately 0.9 mm per year, respectively (Virginia Institute of Marine Science, 2010). On the Virginia Eastern shore, land subsidence has been observed as a result of a meteor strike that occurred 35 MYA (Virginia Institute of Marine Science, 2010). Historically, portions of Maryland have experienced relative sea level rise of approximately one foot over the past century. However, due to regional land subsidence and global climate change, Maryland may experience three to four feet of sea level rise over the next century (Massachusetts Executive Office of Energy and Environmental Affiars, Undated). Along the Gulf Coast, subsidence has been observed from the Mississippi River Delta to Memphis, TN. Portions of the Mississippi Delta are subsiding at 10 to 15 mm per year, and Louisiana is subsiding at 5 to 10 mm per year (American Geophysical Union, 2006). Additionally, large portions of San Jacinto County, TX (Houston metropolitan area), have dropped by several meters over the last century, resulting in loss of wetlands and coastal habitats (USGS, 2007a).

[26] Charleston, SC is highlighted because it possesses the greatest risk from a magnitude 6.0 earthquake in the region.

3.5.5.3 Appalachian Highlands

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock created when the North American plate collided with Eurasian and African plates more than 500 MYA. Once similar in height to the present-day Rocky Mountains, the Appalachian Highlands have eroded considerably, and most peaks are now under 5,000 feet above sea level. The current Appalachian Highlands Region is characterized by prime and unique farmlands and is rich in mineral resources (USGS, 2003b).

Within the Appalachian Highlands, the Piedmont Province, which includes parts of Georgia, South Carolina, North Carolina, Virginia, Maryland, Pennsylvania, and New Jersey, consists of generally rolling ridges with a few hundred feet of elevation difference between the hills and valleys (North Carolina Geological Survey, 2004). The Piedmont's igneous and metamorphic rocks contrasts with the sedimentary formations found in the Atlantic Plain. The Piedmont Province ranges from steeply sloped ridges with highly eroded valleys in the northern sections, to rolling hills and broad plateaus in the southern sections (Georgia Department of Natural Resources, Undated).

3.5.5.3.1 Earthquakes (Seismic Risk)

The Appalachian Highlands are at relatively low risk to significant earthquake activity. The USGS earthquake probability prediction tool estimates that there is a 4 to 6 percent chance of a magnitude 6.0 earthquake occurring in the area near Massena, NY,[27] within the next 100 years (USGS, 2010). Within Virginia's Appalachian Highlands, a magnitude-5.8 earthquake centered in the town of Mineral impacted much of the East Coast in August 2011 (USGS, 2015a). The earthquake occurred in the Central Virginia Seismic Zone, which "extends east-west about 120 km from the Fall Line to Blue Ridge and is about 100 km wide in the north-south direction" (USGS, 2015b). Rock falls attributed to the earthquake occurred more than 150 miles away (USGS, 2015b).

3.5.5.3.2 Landslides

USGS has documented two significant regional landslide events in the Appalachian Mountain Region; both the Nelson County (1969) and Madison County (1995) landslides occurred in Virginia. The 1969 Nelson County event occurred during Hurricane Camille, which produced more than 28 inches of rain during an 8-hour period. This landslide caused more than 150 deaths and more than $100M in infrastructure damage. The 1995 Madison County landslide was triggered by 30 inches of rainfall in the area over a period of 16 hours; during this event, one landslide traveled two miles (USGS, 1997a). One study suggests that 550 individual slides occurred in Madison County during this event. One individual was killed by a debris flow and infrastructure damages exceeded $100M (USGS, 1996a). Landslides in the Appalachian Mountain Region have a recurrence interval of approximately 1 per 2.7 years (USGS, 1997a).

[27] Massena, NY, is highlighted because it possesses the greatest risk from a magnitude 6.0 earthquake in the region.

3.5.5.3.3 Subsidence

Karst topography is a contributor to subsidence in the Appalachian Highlands. In Delaware, karst topography has led to land subsidence and cave formation in the Piedmont Province. Karst areas are confined to portions of the Piedmont underlain by carbonate[28] rocks of the Cockeysville Formation (Talley, 1981). The Hockessin area is underlain by carbonate rocks that are at risk to subsidence (Figure 3-13) (The Delaware Geological Survey, 2015). Six sinkholes[29] were discovered in the Hockessin Valley between 1978 and 1981 (Talley, 1981).

Source: (The Delaware Geological Survey, 2015)

Figure 3-13. Hockessin Sinkhole (1980)

3.5.5.4 Interior Plains

The Interior Plains Region extends between the western edge of the Appalachian Highlands (near States including Ohio, Tennessee, and Alabama) and the eastern edge of the Rocky Mountain System (including states such as Montana, Wyoming, and Colorado) (Fenneman, 1916). Metamorphic and igneous rocks dating to the Precambrian Era (older than 542 MYA) underlie the entire region. There is minimal topographic relief throughout the region, except for the Black Hills of South Dakota. During the Mesozoic Era, much of the Interior Plains were covered by the oceans, resulting in the formation of sedimentary rocks,[30] which lie on top of the Precambrian basement rocks. Erosion from the Rocky Mountains to the west and the Ozark/Ouachita Mountains to the east, also contributed to the formation of sandstone, mudstone,[31] and clay (USGS, 2014e).

3.5.5.4.1 Earthquakes (Seismic Risk)

Most of the Interior Plains Region is at relatively low risk to significant earthquake activity. The largest recorded earthquake in Oklahoma occurred in 2011 and measured 5.6 on the Richter scale (USGS, 2011a). The USGS earthquake probability prediction tool estimates that there is a 3-4 percent chance of a

[28] Carbonate: "A sedimentary rock made mainly of calcium carbonate ($CaCO_3$). Limestone and dolomite are common carbonate sedimentary rocks" (USGS, 2015c).

[29] Sinkhole: "A depression in the surface commonly found in in karst landscapes. Sinkholes often form where limestone or some other soluble rock is partially dissolved by groundwater, then collapses to form a depression. Sinkholes are often "bowl-shaped" and can be a few to many hundreds of meters in diameter" (USGS, 2015c).

[30] Sedimentary Rock: "Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding" (USGS, 2015c).

[31] Mudstone: "A very fine-grained sedimentary rock formed from mud" (USGS, 2015c).

magnitude 6.0 earthquake occurring in the area near Anadarko, OK,[32] within the next 100 years (USGS, 2010).

3.5.5.4.2 Landslides

Landslides may occur on a localized basis when triggered by heavy rains, loss of vegetation due to development, or wildfires (National Atlas of the United States, 2001). Landslides are common in Hamilton County, OH (near Cincinnati) (USGS, 2009a). Hamilton County is susceptible to landslides largely due to its underlying geology; the Kope Formation is exposed throughout the region and contains a highly erodible form of shale. In addition, much of the surface of Hamilton County is covered with unconsolidated glacial deposits, which are vulnerable to landslides (Hamilton County Soil & Water Conservation District, 2011). In 1996, Hamilton County experienced a series of landslides in soil and shale.[33] An estimated 180 truckloads of debris slid onto Columbia Parkway and shut down the highway for several days (Cincinnati.com, 2012); infrastructure damage repair and mitigation exceeded $10M. In 2008, roughly 35 landslides were reported in the Hamilton County area (Hamilton County Soil & Water Conservation District, 2011).

3.5.5.4.3 Subsidence

Widespread land subsidence in the Interior Plains due to groundwater withdrawals is not a major concern (Kansas Geological Survey, 2011). Localized subsidence has been observed in Hutchinson, KS, where three areas of land subsidence were observed between 1914 and 1952 due to salt mining, which began in 1888. During May 1914, a 150-ft wide, 15-ft deep sinkhole formed near the Morton Salt Company Factory (Kansas Geological Survey, 1978). In Nebraska, land subsidence due to sinkhole formation has occurred in isolated areas (Nebraska Emergency Management Agency, 2014). For example, in 2009, the Bureau of Reclamation documented sinkholes below the Red Willow Dam near McCook in the southern part of the State (Bureau of Reclamation, 2009).

3.5.5.5 Interior Highlands

The Interior Highlands Region includes the elevated portions of Illinois, Missouri, Arkansas and Oklahoma, and stand in contrast to the flat-lying surrounding areas of the Interior Plains and Atlantic Plains Regions. The Interior Highlands are composed of Paleozoic (542 to 241 MYA) sedimentary rocks. Beginning about 340 MYA, these rocks were uplifted and deformed to form a large mountain range, much of which has subsequently eroded. The remnants of this mountain range are seen today in the Ouachita-Ozark Highlands. (USGS, 2014f)

3.5.5.5.1 Earthquakes (Seismic Risk)

The Interior Highlands contain one of the country's largest fault systems east of the Rocky Mountains: the New Madrid Seismic Zone (NMSZ). Over the past 4,500 years, several magnitude 7.0 to 8.0 earthquakes have occurred in this area, including the historic 1811–1812 series of 4 magnitude 7.0 to 8.0 earthquakes,

[32] Anadarko, OK is highlighted because it possesses the greatest risk to a magnitude 6.0 earthquake in the region.
[33] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks. Shaley means like a shale or having some shale component, as in shaley sandstone" (USGS, 2015c).

which took place over a 4-month period. Widespread portions of the Midwest are at risk to damaging earthquakes due to their proximity to the NMSZ, which includes portions of Illinois, Missouri, Kentucky, Tennessee, and Arkansas (USGS, 2012c). "The [NMSZ] appears to be about 30 years overdue for a magnitude 6.3 quake because the last quake of this size occurred 100 hundred years ago at Charleston, Missouri, on Oct. 31, 1895 (it was a magnitude 6.7)… About 75 percent of the estimated recurrence time for a magnitude 7.6 earthquake has elapsed since the last quake of this size occurred in 1812" (Missouri Department of Natural Resources, 2015). The USGS earthquake probability prediction tool estimates that there is a 25 to 30 percent chance of a magnitude 6.0 earthquake occurring along the New Madrid Fault within the next 100 years. An earthquake of this magnitude would impact major cities such as Memphis, TN; Little Rock, AR; and St. Louis, MO. (USGS, 2009b)

3.5.5.5.2 Landslides

Portions of the Interior Highlands are susceptible to landslides, particularly in western Arkansas (Arkansas Geological Survey, 2015a). Landslides in Arkansas are typically associated with "road building, where excavations into the hillsides have over-steepened and reduced natural slope stability. Over-steepening of slope and removal of vegetation combined with large amounts of rainfall contribute to landslide development" (Arkansas Geological Survey, 2015b). One notable landslide event in Arkansas occurred in 2008, when soil saturation and excessive stormwater runoff caused a landslide that blocked Richland Creek Road in Searcy County (in northern Arkansas about 75 miles north of Little Rock). Shale- and clay-based units moved 100 feet during the slide (Chandler & Doerr, 2008).

3.5.5.5.3 Subsidence

Subsidence risk exists in small pockets throughout the Interior Highlands region. In Oklahoma, one potential cause of land subsidence is the collapse of karst. Karst topography is most prevalent within eastern Oklahoma, particularly in Mississippian (359 to 318 MYA) limestone units (Johnson, 2008). A second cause of land subsidence in Oklahoma is mine collapse. "Subsidence is recognized to occur in the Picher [(in northeastern Oklahoma)] area, as well as in portions of eastern Oklahoma which were active coal mining areas from the late 1800s until the mid-1900s" (Oklahoma Department of Emergency Management, 2014). Counties at risk of subsidence include Atoka, Coal, Craig, Haskell, Latimer, LeFlore, Mayes, McIntosh, Muskogee, Nowata, Okmulgee, Pittsburg, Rogers, Sequoyah, Tulsa, and Wagoner counties. Nearly 500 mine shafts in Oklahoma are at risk of collapse (Oklahoma Department of Emergency Management, 2014).

3.5.5.6 Rocky Mountain System

The Rocky Mountains constitute a line from the northern border with Canada south into central New Mexico. The Rocky Mountains formed during the Laramide orogeny,[34] which occurred between 70 and 40 MYA. They formed due to the collision of the Pacific Ocean oceanic crust[35] with the North American continental crust. In most cases, convergence of oceanic crust with continental crust results in mountain formation 200 to 400 miles from the coastline; however, given the low angle of subduction by which the

[34] Orogeny: "An episode of mountain building and/or intense rock deformation" (USGS, 2015c).
[35] Crust: "The rocky, relatively low density, outermost layer of the Earth" (USGS, 2015c).

oceanic crust passed under the less dense continental crust during the Laramide orogeny, the Rocky Mountains arose several hundred miles further inland than is normally observed. (USGS, 2014g)

3.5.5.6.1 Earthquakes (Seismic Risk)

A relatively high-risk zone of potential seismic activity extends throughout portions of the Rocky Mountain System. Within Utah, areas of greatest seismicity are focused in the central portion of the State running from north to south. Weber, Davis, Salt Lake, Utah, and Juab Counties are at the greatest risk of strong earthquakes within Utah, due to their proximity to the Wasatch Fault, a 240-mile long geologic feature that extends between Malad City, and Fayette, UT (Utah Geological Survey, 1997). On average, six magnitude 3.0 (or greater) earthquakes occur within Utah in a given year. Magnitude 6.0 (or greater) earthquakes occur in Utah, on average, once every 20 years (Utah Geological Survey, 1997). Utah's largest recorded earthquake measured 6.6 on the Richter scale, and occurred in Hansel Valley in northern Utah in 1934. The earthquake produced landslides and multiple ground fractures; in some locations, the terrain was displaced by more than one foot (USGS, 2014h).

In Wyoming, areas of greatest seismicity are concentrated in the northwest portions of the State; locations within Yellowstone National Park are at the greatest risk of experiencing a significant earthquake (Wyoming State Geological Survey, 2015c). On average, between 1,000 and 3,000 earthquakes occur annually within Yellowstone National Park, including several magnitude 3 to 4 earthquakes (USGS, 2005). "The largest earthquake recorded to date in Wyoming occurred on August [18], 1959 in Yellowstone National Park. The earthquake registered as a magnitude 6.5 and is considered to be an aftershock of the magnitude 7.5 Hebgen Lake earthquake in southwestern Montana" (Wyoming State Geological Survey, 2015c). The USGS earthquake probability prediction tool estimates that there is a 60 to 80 percent chance of a magnitude 6.0 earthquake occurring in northwestern Wyoming (north of Jackson[36]) within the next 100 years (USGS, 2010).

3.5.5.6.2 Landslides

Several significant landslide events have been documented in the Rocky Mountain System. During 1983 and 1984, multiple landslides in Utah resulted in more than $500M in infrastructure damage. The 1983 Thistle landslide was the most expensive landslide in nation's history. This landslide, which was caused by significant rainfall and snowmelt, blocked three major transportation arteries, including the main transcontinental line of the Denver and Rio Grande Western Railroad. (USGS, Undated).

3.5.5.6.3 Subsidence

In Montana, more than 6,000 abandoned mines have been documented, some of which are at risk of collapse (Montana Department of State Lands, 1995); most of Montana's mines are in the western portion of the State within the Rocky Mountain System (Montana Department of Environmental Quality, 2015). In recent years, Montana has been studying the potential for mine-induced subsidence at the Red Lodge Mine, which is in southern Montana north of Yellowstone National Park (Montana Department of

[36] Jackson, WY, is highlighted because it possesses the greatest risk to a magnitude 6.0 earthquake in the region.

Environmental Quality, 2014). The study concluded that trough subsidence[37] had occurred on the order of 3 to 7 inches with the potential to cause "slight to appreciable" damage to buildings. The study also indicated that two potholes had developed in Red Lodge due to mine subsidence (Pioneer Technical Services, Inc. - Prepared for Montana Department of Environmental Quality, 2015).

Portions of western Montana are underlain by carbonate rocks that are subject to the formation of karst topography (USGS, 2004). The Mississippian (359 to 318 MYA) Madison Limestone is the major geologic unit that contributes to the formation of karst topography throughout southern Montana. At Bighorn Canyon National Recreation Area, the Madison Limestone has formed more than 14 miles of caves (NPS, 2015b).

3.5.5.7 Intermontane Plateaus

West of the Rocky Mountain System is the Intermontane Plateaus Region. The region comprises Colorado Plateau (covering portions of Colorado, Utah, Arizona, and New Mexico) and the Columbia Plateau (covering eastern Washington and parts of Oregon and Idaho). The Colorado Plateau is composed primarily of relatively flat sedimentary rock that was uplifted during tectonic events, whereas the Columbia Plateau resulted from volcanic activity. (USGS, 2003b)

3.5.5.7.1 Earthquakes (Seismic Risk)

The motion between the North American, Pacific, and Juan de Fuca tectonic plates causes frequent seismic activity throughout western North America. Most activity occurs close to the plate boundaries in California and off the Oregon and Washington coasts, but a significant part of this deformation extends eastward throughout the Basin and Range Province of Nevada and Utah (USGS, 2012d). Nevada is in one of the most seismically active regions in the United States. Nevada ranks 3rd (behind California and Alaska) nationwide in the number of large earthquakes over the last 150 years (University of Nevada, Reno, 2015a). Areas of greatest seismicity in Nevada are concentrated in the western portions of the State (USGS, 2014i). The largest earthquake ever recorded in Nevada was a magnitude-7.1 quake that occurred in 1915 the eastern part of Pleasant Valley, in north-central part of Nevada. Damage occurred within an 80 km radius of the earthquake in Humboldt, Lander, and Pershing Counties, and the earthquake was felt in parts of Oregon, California, and Utah (USGS, 2012e). The USGS earthquake probability prediction tool estimates that there is an 80 to 90 percent chance of a magnitude 6.0 earthquake occurring in the Lake Tahoe/Reno/Carson City, NV[38] area within the next 100 years (USGS, 2010).

3.5.5.7.2 Landslides

Landslides may occur on a localized basis in parts of the Intermontane Plateaus, when triggered by heavy rains, loss of vegetation, or wildfires (National Atlas of the United States, 2001). For example, in New

[37] Trough Subsidence: Subsidence that occurs "when the overlying soils (or overburden) [sag] downward due to the failure of remnant mine pillars or by punching of the pillars into a soft mine floor" (Pioneer Technical Services, Inc. - Prepared for Montana Department of Environmental Quality, 2015).

[38] The Lake Tahoe/Reno/Carson City, NV area is highlighted because it possesses the greatest risk to a magnitude 6.0 earthquake in the region.

Mexico heavy rains in the Basin and Range Province can trigger debris flow[39] landslides at higher elevations. Road building in mountainous areas can increase the probability of landslides (Radbruch-Hall, et al., 1982).

3.5.5.7.3 Subsidence

Examples of subsidence are localized in the region (USGS, 2000). For example, in Nevada, subsidence due to underground water withdrawal has been observed in the Las Vegas Valley, where 20 percent of the water supply comes from groundwater withdrawals. Beginning in 1946, extraction of groundwater exceeded the volume of water that infiltrated into the ground. Withdrawals have exceeded groundwater recharge since that time, resulting in a decline in the water table by more than 290 feet and the compaction of aquifer sediments (Bell, Price, & Mifflin, 1992). Throughout the Las Vegas Valley, ground surface elevations have dropped by 6 feet since the 1930s (University of Nevada, Reno, 2015b).

In New Mexico, land subsidence is attributable to collapsible soils.[40] Collapsible soils are common in areas that are underlain by clay and where unconsolidated eroded sediments have collected at the bases of foothills and within adjacent valleys. Collapsible soils have been observed in Las Cruces (south-central New Mexico), Alamogordo (south-central New Mexico), and Socorro (west-central New Mexico) (Love, 2015). Another significant cause of land subsidence in New Mexico is the formation of caves and sinkholes due to karst topography, which is common in southern New Mexico in areas underlain by carbonate rocks (USGS, 1995).

3.5.5.8 Pacific Mountain System

The Pacific Mountain System's geology is younger than the eastern continental United States, and spans from southern California northward to Alaska. The region tectonically active, and contains the majority of active volcanoes in North America, as well as the highest mountain on the continent, Mount McKinley in Alaska. It is characterized primarily by igneous rocks, which resulted from volcanic activity. (USGS, 2003b)

3.5.5.8.1 Earthquakes (Seismic Risk)

The Pacific Mountain System includes the most seismically active region in the United States. Between 1974 and 2003, more than 87 percent of the magnitude 3.5 or greater earthquakes occurring in the United States originated in Alaska, Hawaii, and California. (USGS, 2012f)

California is particularly vulnerable to earthquake activity due to the dozens of active faults and fault zones in the State. On average, the southern California area experiences about 10,000 earthquakes annually, with most of these not felt and only several hundred are greater than magnitude 3.0 on the Richter scale. Earthquakes with a magnitude of greater than 4.0 account for only 15 to 20 earthquakes

[39] Debris Flow: "A type of landslide made up of a mixture of water-saturated rock debris and soil with a consistency similar to wet cement. Debris flows move rapidly downslope under the influence of gravity. Sometimes referred to as earth flows or mud flows" (USGS, 2015c).

[40] Collapsible Soils: "Collapsible soils are soils that compact and collapse after they get wet. The soil particles are originally loosely packed and barely touch each other before moisture soaks into the ground. As water is added to the soil in quantity and moves downward, the water wets the contacts between soil particles and allows them to slip past each other to become more tightly packed" (Love, 2015).

(USGS, 2014j). California experiences about 40 mm of slip per year on the faults of the San Andreas system and about 10 mm per year in the Mojave Desert and Basin and Range area east of the Sierra Nevada on a fault system (also referred to as the eastern California shear zone) (California Emergency Management Agency, 2013). Areas of greatest seismicity in California are concentrated along the coast, particularly along the San Andreas Fault. Two of the most powerful earthquakes recorded to date are the 1857 Fort Tejon earthquake (magnitude 7.9) and the 1906 San Francisco earthquake (magnitude 7.8). The Fort Tejon earthquake uprooted trees and destroyed buildings up to 20 km away. (USGS, 2014k)

Within California, earthquakes of magnitude 7.0 to 7.9 occur approximately every 10 years, and earthquakes of magnitude 6.0 to 6.9 occur every two to three years. No earthquake with a magnitude 8.0 or greater has been officially recorded in the State. It is estimated that there is a 63 percent chance that a magnitude 6.7 earthquake will hit the San Francisco area before 2032, and between 80 and 90 percent likelihood that a magnitude 7.0 earthquake will hit southern California before 2024. (California Emergency Management Agency, 2013)

3.5.5.8.2 Landslides

The majority of landslide incidents and hazards within the United States have occurred within the Pacific Mountain System. Of the 18 regional-scale landslide events documented by USGS between 1906 and 1998, 13 occurred in California (9), Washington (2), Alaska (1), or Hawaii (1). Twenty-four local landslide events were documented in California between 1925 and 1999 (USGS, Undated). These landslide events were precipitated by a number of different causes:

- In 1971, a 7.5-magnitude San Fernando earthquake resulted in a massive slope failure upstream of the Lower Van Norman Dam. The landslide damaged the dam and 80,000 people were forced to evacuate. Economic and infrastructure damage from landslides attributed to the earthquake exceeded $300M.
- The 1972 Big Sur Landslide resulted from August wildfires and subsequent multi-day rainstorms in October. These events inundated highways, automobiles, and houses with mud and debris, and resulted in more than $26.5M in damage.
- In 1998, heavy rains produced the Anzar Road Landslide, which destroyed one home, severed a natural gas pipeline, and resulted in $746M in economic and infrastructure damage.

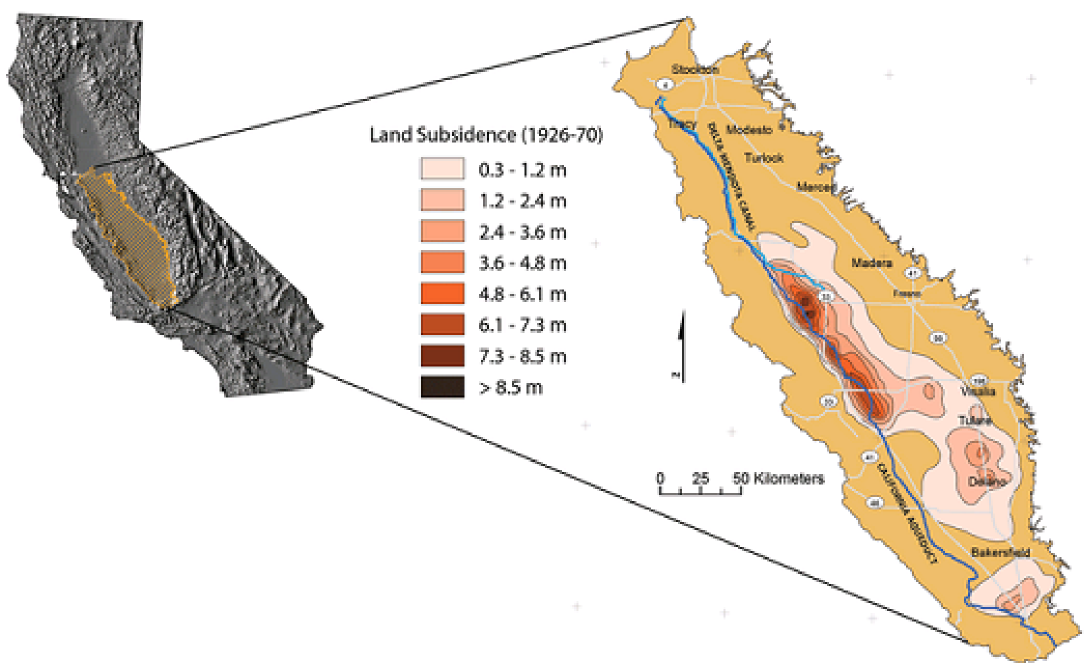
Numerous significant landslide events have affected Washington State within the last century, including:

- A series of landslides affected Lake Roosevelt throughout the 1930s–1970; a large number of those events are attributed to the rapid drawdown of the Lake Roosevelt Reservoir and the resultant decreased pore pressure in surrounding sediments. The Lake Roosevelt landslides created large waves, including one at 65 feet high. (Department of the Interior, 1997)
- A series of landslides also occurred in Washington following the 1980 eruption of Mt. St. Helens. Debris destroyed nine highway bridges, extensive lengths of highways, and countless private and public buildings. The low casualties (5 to 10 people) were attributed to evacuation warnings before the eruption. (USGS, Undated)

- In March 2014, a landslide struck the town of Darrington, WA in Snohomish County. The 1,500 feet-wide wall of terrain buried structures in up to 15 feet of mud. The landslide was likely caused by excessive rainfall during the preceding 45 days. (USA Today, 2014)

3.5.5.8.3 Subsidence

Subsidence caused by groundwater/fluid withdrawals is a problem throughout the southwestern Pacific Mountain System. Extraction of oil from the Wilmington Oil Field in California caused land subsidence of approximately 0.75 meters per year (NASA, 2013). Total subsidence reached nine meters before the land surface was stabilized by re-injecting fluids into the ground. An extreme example of land subsidence occurred in the San Joaquin Valley (California), where the ground has dropped nearly 10 meters since the 1920 due to groundwater withdrawals (USGS, 2000). More than 5,200 square miles of agricultural land has been affected by land subsidence in the San Joaquin Valley (Figure 3-14) (California Department of Water Resources, 1984).



Source: (USGS, 2012g)

Figure 3-14: Ground Subsidence Map for the California San Joaquin Valley

3.5.5.9 Other Territories

Several States and territories do not fall into the above-mentioned physiographic regions, including Hawaii, American Samoa, the Northern Mariana Islands, Guam, USVI, and Puerto Rico.

The Hawaiian Islands are volcanic islands in the Pacific Ocean, created by hot-spot activity below the Earth's surface. Although most of the volcanoes are extinct, activity continues at several volcanoes on the island of Hawaii, including Mt. Kilauea. American Samoa, the Northern Mariana Islands, and Guam are volcanic islands in the Pacific Ocean and susceptible to seismic activity. Volcanic rock forms the geologic foundation of the islands, with sedimentary rock overlaying some portions. The USVI and

Puerto Rico are in the Caribbean Sea and of volcanic origin; they are composed of igneous rock overlain with more recent sedimentary deposits. (NPS, 2013a)

The Hawaiian Islands are susceptible to regular earthquakes including several events greater than magnitude 6.5 that have occurred within the last 80 years. Guam and the Northern Marianas are susceptible to earthquakes as well.

Landslide and subsidence data are not available for Hawaii or the territories.

3.6 WATER RESOURCES

Unit of Analysis
USGS HUC-2 Watersheds

3.6.1 Definition of the Resource

Water resources include surface waters and groundwater used by both natural and built systems. Surface water elements are lakes, ponds, rivers, and streams, as well as estuarine and coastal waters. Groundwater includes all underground water that occupies pore spaces between sand, clay, and/or rock particles. Aquifers are underground layers of water-bearing rock.

This section provides a summary of surface water and groundwater uses throughout the United States and consideration is given to the differences between freshwater and estuarine/coastal waters. Additional analysis is provided for the public water supply. Floodplains are closely integrated with the function and utility of all water resources due to their effect on water moving toward the coast (from upland precipitation and snowmelt) and floodwaters moving landward (from upstream and offshore storms). The unit of analysis for this section, USGS HUC-2 watersheds, was selected to logically divide the continental United States into 18 watersheds that can be analyzed for their respective unique characteristics pertaining to water resources. Three additional HUC-2 watersheds are discussed for Alaska, Hawaii, and the Caribbean (Puerto Rico and the USVI).

3.6.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. The NFIP is influenced by these laws and policies because of the relationship to wetlands and floodplains and the mapping associated with these areas, as well as the need for permit compliance with Federal laws. Descriptions of applicable laws and regulations for Water Resources are provided below.

3.6.2.1 Clean Water Act

The Clean Water Act (CWA), passed in 1972, establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Through a variety of regulatory and non-regulatory initiatives, the CWA is designed to restore and maintain the chemical, physical, and biological integrity of the nation's waters, including wetlands. Sections 401 and 404 of the CWA most directly influence development and related activities within floodplains.

Section 404 of CWA establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. "Fill material" includes not only soil or dredge material, but also bridge footings, pier pilings, and other man-made materials. A Section 404 permit must be obtained from the USACE for any activity that includes the discharge of dredged or fill material into waters of the United States, including wetlands. Section 404 permits are either individual or general. Individual permits are required for specific activities that may potentially create significant impacts, such as the construction of dams, levees, and highways along a waterway. General permits may be granted by the USACE on a nationwide, statewide, or regional basis for activities that produce minimally adverse effects, such as minor culvert or road crossings over streams. Thus, the USACE has a direct authority to regulate waters of the United States, including wetlands, and Section 404 permitting is one regulatory mechanism that affects development within riverine and coastal floodplains.

The EPA plays a key oversight role in the implementation of Section 404 through the Section 401 water quality certification process, which is required for issuance of a Section 404 permit. In some States, Section 401 authority is delegated to a State regulatory agency. The main function of Section 401 is to allow State and Tribal jurisdictions to review and approve, condition, or deny all Federal permits or licenses that may produce discharge within the jurisdiction's waterway. Applicants for a Federal license or permit must demonstrate that either the State in which the proposed discharge will originate or the interstate water pollution control agency with jurisdiction over the navigable waters in question has approved the proposed development. As a result, all Federal permits, including those issued by USACE, must also meet all applicable State (or interstate) water management provisions. Throughout the Section 404/401 process, the USFWS, NOAA Fisheries, and State resource agencies all play an advisory role for USACE and EPA.

In most cases, the jurisdictional limit of Sections 404 and 401 permitting is the highest tide line in tidal areas and the ordinary high water mark along freshwater waterways. Wetlands and relatively permanent tributaries with a connection to navigable waters are also generally under Sections 404 and 401 jurisdiction. While floodways typically fall entirely within the jurisdictional limit of Sections 404 and 401 permitting, the full extent of the SFHA may not.

In addition to these aspects of the CWA, the National Pollutant Discharge Elimination System (NPDES) Stormwater Program is a comprehensive, two-phased national program for addressing the non-agricultural sources of stormwater discharges that adversely affect the quality of the nation's waters. The program uses the NPDES permitting mechanism to require the implementation of controls designed to prevent harmful pollutants from being washed into local water bodies by stormwater runoff. The NPDES permit requirements include mandatory permits for any earth moving or ground clearing for areas larger than one acre. Implementation of the program will provide a higher degree of agency review and corresponding measures to protect aquatic resources.

3.6.2.2 Coastal Zone Management Act

The CZMA is administered by the Department of Commerce's Office of Coastal Resource Management and NOAA and applies to all coastal states and to all States that border the Great Lakes. The CZMA was established to help prevent additional loss of living marine resources, wildlife, and nutrient-enriched areas; alterations in ecological systems; and decreases in undeveloped areas available for public use. The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active State involvement in achieving these goals. The CZMA requires participating coastal States to develop coastal zone management programs to effectively manage coastal zones within State boundaries. Each State CZM program must include provisions protecting coastal natural resources, fish, and wildlife; managing development along coastal shorelines; providing public access to the coast for recreational purposes; and incorporating public and local coordination for coastal decision-making. Upon Federal approval of a State's coastal zone management program, the State becomes eligible for Federal coastal zone grants. Development projects within the coastal zone must demonstrate compatibility with the State's coastal zone program and apply for a coastal zone permit. Additionally, review by other regulatory agencies, such as the USFWS and NOAA Fisheries is typically part of a coastal zone permit review.

For projects in the coastal zone that are funded, authorized, or carried out by a Federal agency, a Federal consistency determination is submitted to the State as confirmation the project is consistent with the State coastal zone program. The CZMA gives states the authority to determine whether activities of governmental agencies are consistent with federally approved CZM programs. Any activities approved by communities participating in the NFIP that may have an effect on any land or water use or on any natural resources in the coastal zone must conform to the enforceable policies of the approved State CZM program. This voluntary Federal-State partnership addresses coastal development, water quality, shoreline erosion, public access, protection of natural resources, energy facility siting, and coastal hazards.

3.6.2.3 EO 11988 (Floodplain Management)

Issued in 1977, EO 11988, *Floodplain Management*, requires all Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative. The EO affects actions including the acquisition, management, and disposal of Federal facilities and land; federally undertaken, financed, or assisted construction and improvements; and Federal programs and activities affecting land use (42 FR 26951). Prior to any Federal action, the agency must conduct an 8-step process to determine whether the proposed action will occur in the floodplain; identify and evaluate practicable alternatives "to avoid adverse effects and incompatible development in the floodplains;" identify the impacts of the proposed action; develop measures to minimize potential harm to people, property, and floodplains; and provide an opportunity for public review and comment.

3.6.2.4 EO 11990 (Protection of Wetlands)

EO 11990, *Protection of Wetlands*, requires Federal agencies to minimize the destruction, loss, or degradation of wetlands, including waters of the United States, and to preserve and enhance the natural and beneficial values of wetlands. Before implementing an action that is located in, or may affect, a wetland, this EO requires Federal agencies to demonstrate that there is no practical alternative and the proposed action includes all practical measures to minimize harm to the wetlands. The Federal agency must also provide an opportunity for early public review by those who may be affected and include findings in its environmental or other appropriate decision documents.

3.6.3 Existing Conditions—Nationwide Water Resources

Floodplains, surface water, groundwater, and other water resource elements function as integrated components throughout watersheds, and provide a variety of environmental services, including groundwater recharge, wildlife habitat, flood attenuation, and pollutant removal. Natural and human-made subsystems are integrated, and disruption of one part of this system influences the functions and services provided by water resources. The following describes the major elements of water resources evaluated in this analysis: floodplains, surface water, groundwater, and water supply and use.

3.6.3.1 Floodplains

A floodplain is the lowland found along inland or coastal waters, including flood-prone areas of offshore islands. As defined by FEMA in 44 C.F.R. §59.1, a floodplain[41] is any land area susceptible to being inundated by water from any source (FEMA, 2006a).

A typical floodplain is a broad, flat area with higher elevations on the landward sides. Due to their development by deposition of nutrient-rich sediment, floodplains are usually very fertile agricultural areas. Because they are naturally flat and along navigable waterways, floodplains are often developed for transportation infrastructure, industrial and commercial purposes, and wastewater treatment works (Wright, 2008). In 1977, the United States Water Resources Council estimated that about 7 percent of the United States (including Alaska and Hawaii) was within the 100-year floodplain, totaling nearly 279,688 square miles (Natural Hazards Research and Applications Information Center, 1992).

The EPA estimates that there are more than 3.5 million miles of stream and rivers within the United States (EPA, 2013c). It is important to note that rivers and streams are constantly changing as they respond to natural and human influences that, in turn, directly affect the floodplains and result in constant fluctuations in overall floodplain acreages. There are three types of floodplains:

- **Riverine floodplains** range from narrow confined channels (as in steep river valleys in hilly and mountainous areas) to wide, flat areas (as in much of the Midwest and in many coastal areas). In steep, narrow valleys, floodwaters build and recede quickly, with fast moving and deep water. Correspondingly, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. Riverine-type flooding occurs along rivers, streams, ditches, and other waterways that are subject to overbank flooding, flash floods, and urban drainage system flooding. (Wright, 2008)
- **Mountainous floodplains** are in ranges characterized by steep river valleys or peaks that have eroded into alluvial fans. Alluvial fans are loosely packed rock and soil regions that have eroded from mountainsides and accumulated on valley floors in a fan-shaped pattern. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Large volumes of sediment and debris, including boulders and trees, can wash across mountainous floodplains. (Wright, 2008)
- **Coastal floodplains** border an ocean or large lake and are affected with rising waters without the protection of an estuary. Most coastal floods are caused by coastal storms, such as nor'easters and hurricanes. (FEMA, 2013c)

Over the long term, flood events shape floodplain topography and soils, and correspondingly influence the ecology of the floodplain. One of many economically valuable functions of floodplains is to reduce the impact of floods. Except in narrow, steep valleys and areas of coastal bluffs, floodplains provide an

[41] By comparison, an SFHA is the land area covered by the floodwaters of a base flood on NFIP maps. The SHFA is the area where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. (FEMA, 2016)

area to slow and temporarily store floodwater. Floodwater storage is particularly important in urban areas where even relatively small and short duration floods can cause severe damage. One acre of floodplain land flooded one foot deep holds 330,000 gallons of water (Wright, 2008). In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main waterbody (FEMA, Undated).

3.6.3.2 Surface Water

3.6.3.2.1 Freshwater Systems

Freshwater streams and rivers are the dynamic interconnected systems of moving water. Streams can be perennial (flow year-round), intermittent (flow during wet portions of the year), ephemeral (flow only during and immediately after rain events), or interrupted (perennial flows that go underground in karst terrain) (EPA, 2013c). Smaller streams join to form larger streams, and the coming together of streams eventually forms rivers. Ultimately, rivers flow into lakes or estuaries. Reservoirs are rivers that have been dammed for human uses (e.g., water supply, power generation, recreation). Surface water found in rivers, streams, creeks, lakes, and reservoirs supplies public water systems, industrial uses, and agriculture irrigation. Approximately 77 percent of the freshwater used in the United States is obtained from surface water sources (USGS, 2013e). Surface water also supports habitat for fish and wildlife, recreational uses, and other innumerable socioeconomic and culturally important activities and values.

3.6.3.2.2 Estuarine and Coastal Systems

Estuaries are ecological transition zones between freshwater river systems and saltwater oceanic systems. Due to their chemically and geographically diverse environment, estuaries support a wide range of wildlife that are often economically important elements of coastal areas. Among other things, estuaries supply water for industrial uses, are the critical terminals of the nation's marine transportation system, provide a point of discharge for municipalities and industries, and are the downstream recipient of nonpoint-source runoff (EPA, 2012b). The heavy concentration of human activity in coastal areas, combined with pollutants flowing from streams far inland and carried through the air great distances, are the primary causes of nutrient enrichment, hypoxia (low oxygen environment), harmful algal blooms, toxic contamination, increased sedimentation, and other problems in coastal waters (U.S. Commission on Ocean Policy, 2004).

The water quality of surface waters is described in terms of the ability of the waterbody to support particular uses (e.g., for public water supply; protection of fish, shellfish, and wildlife habitat or consumption; and recreational, agricultural, industrial, and navigational purposes) and whether water quality standards are met for pollutants, nutrients, pathogens, and physical measurements (e.g., pH and turbidity). (USGS, 2009c)

In estuarine and coastal environments, water quality is influenced by river drainage, including sediments, and wet (e.g., precipitation) and dry (e.g., dust) atmospheric deposition. The natural oceanic processes of mixing and circulation can either improve the water quality through flushing or contribute to the decline in water quality. Besides these natural inputs, human activities affect water quality through discharges, runoff, burning, dumping, air emissions, and oil or chemical spills. (Bricker, Rice, & Bricker, 2014)

3.6.3.2.3 Relationship of Surface Waters to Floodplains

Floodplains serve important functions in surface water management and pollutant removal. Upland runoff that crosses a barren floodplain can carry large amounts of sediment and debris to the main waterbody. A vegetated floodplain, however, slows the surface runoff causing it to deposit sediment and debris on the floodplain. Floodplain vegetation also filters incoming floodwaters originating from the waterway, including sediment scoured from the channel bank and channel bed. This filtering process enriches floodplain soils with nutrients, remediates biodegradable pollutants, and sequesters persistent toxicants. Natural floodplain systems further serve to reduce or avoid the environmental and economic costs associated with wastewater treatment and water quality maintenance. (FEMA, Undated)

3.6.3.3 Groundwater

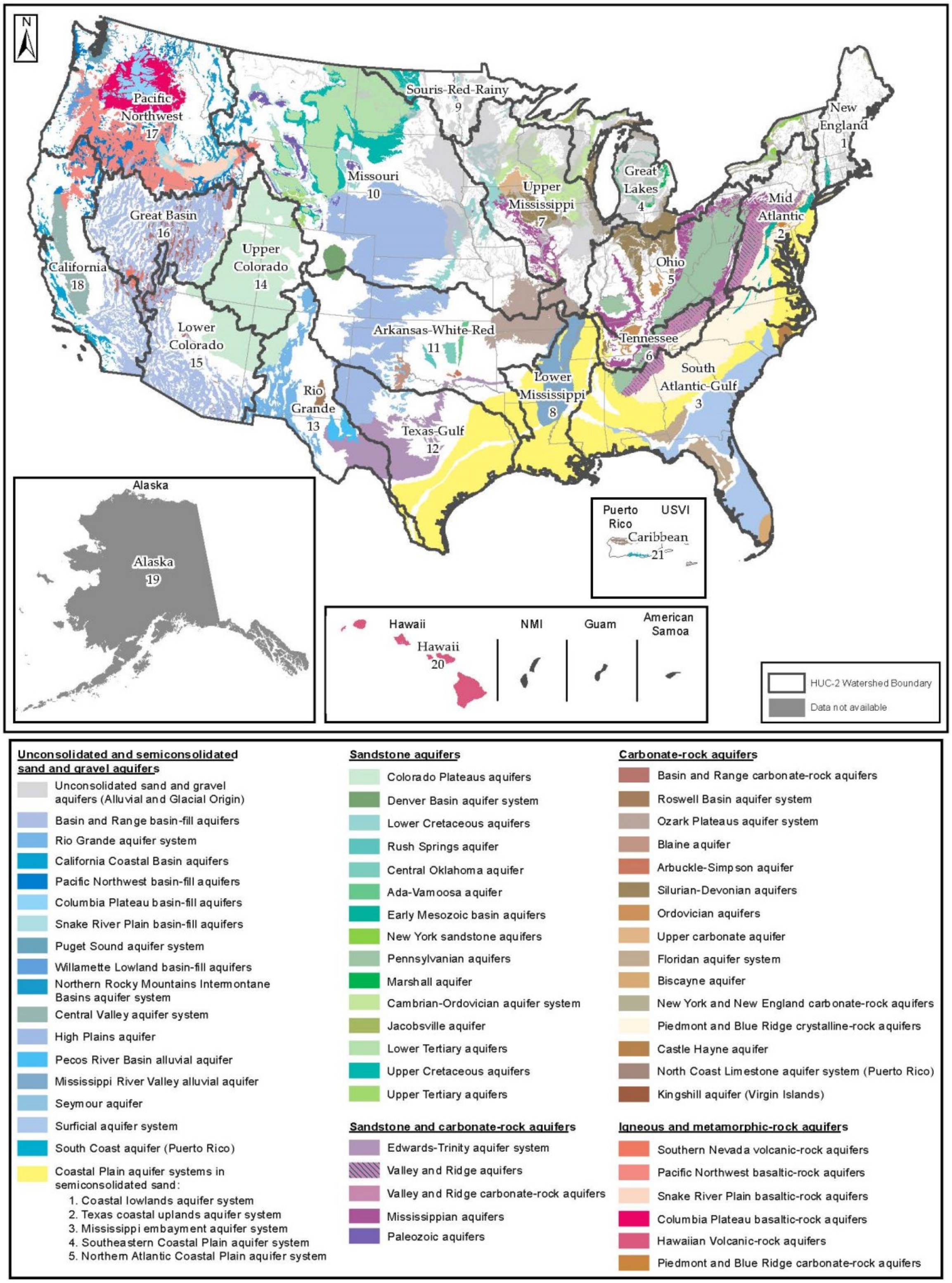
Groundwater is the water beneath the land surface that fills porous spaces in rock and sediment (USGS, 1999a). It is an essential resource often used for potable water consumption, agricultural irrigation, and industrial applications. Groundwater discharge to surface waters allows streams to flow beyond rain and snowmelt periods and sustains lake levels during dry spells. An aquifer is a geologic layer that transmits water to wells and springs. Aquifers can be unconfined (no layer to restrict the vertical movement of groundwater) or confined (bounded by clays or nonporous bedrock). Aquifers can include unconsolidated, semi-consolidated, or consolidated materials. (USGS, 2015d)

A principal aquifer is a regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water. Principal aquifers by rock type include sand and gravel, sandstone, carbonate, and igneous and metamorphic (volcanic) rock (or sometimes two adjoining rock types) (USGS, 2003c). Figure 3-15 displays the 62 principal aquifers and HUC-2 watersheds nationwide.

The EPA defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and these areas have no other drinking water sources. Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized. There are 78 SSAs across the country. (EPA, 2015c)

3.6.3.3.1 Relationship of Groundwater to Floodplains

Natural floodplains possess characteristics that favor local ponding, flood detention, and subsurface conditions supporting infiltration and storage. During high-water events, some floodwater is absorbed by the groundwater system which helps to prevent the river/creek/lake from overflowing. The absorbed water can then be returned to the waterbody during times of low water. If a high-water event is large enough, water will overflow the channel of the river and flow onto and spread over the floodplain, which slows the flow of the water. The reduced water velocity of the upstream floodplain reduces downstream erosion and flooding. The slowing of runoff across the floodplain also facilitates infiltration and recharge of aquifers. (Wright, 2008)



Source: (Natural Resources Conservation Service, 2014)

Figure 3-15: USGS HUC-2 Watersheds and Principal Aquifers

Water yielding aquifers, such as unconsolidated and semi-consolidated sand and gravel aquifers, carbonate-rock aquifers, and sandstone and carbonate-rock aquifers, tend to have more interaction with floodwaters than other primary aquifers due to rock formations. The unconsolidated sand and gravel aquifers are susceptible to contamination because of how easily water moves through them. Water enters the carbonate-rock aquifers rapidly through large openings; any contaminants in the water can therefore rapidly enter and spread through the aquifers. (Miller, 1999)

3.6.4 Existing Conditions—HUC-2 Watersheds

For this NPEIS, existing conditions are described using HUC-2 watersheds for a national level characterization of water resources in the United States. Evaluations of HUC-2 watersheds focus on critical aspects of floodplains, surface water, and groundwater within each watershed. Refer to Section 3.1.3 for a more detailed discussion of this unit of analysis and Figure 3-3 for the HUC 2 watersheds and FEMA regions.

3.6.4.1 New England (01)

HUC-2 New England (01) watershed drains into: (a) the Bay of Fundy; (b) the Atlantic Ocean within and between the States of Maine and Connecticut; (c) Long Island Sound north of the New York-Connecticut State line; and (d) the Riviere St. Francois, a tributary of the St. Lawrence River. This includes all of Maine, New Hampshire and Rhode Island and parts of Connecticut, Massachusetts, New York, and Vermont (USGS, 2013f). The New England watershed contains a mixture of rugged mountains, narrow to broad valleys, and flat plains. Parts of FEMA Regions I and II fall within this watershed.

3.6.4.1.1 Floodplains

Rivers and streams in New England typically inundate floodplains in the winter and spring, often because of precipitation, snowmelt, and ice jams. Flooding also occurs in older urban areas where floodplain development has removed floodwater storage capacity. Floodplains are relatively small throughout hilly or mountainous parts of the area, due to steep topography, which can cause an increased chance of flash flooding. (USGS, 2001a)

New England flooding occurs year-round from many different types of meteorological events. A single large rainfall event may be sufficient to cause minor to moderate flooding. However, the largest floods in the northeast have generally been caused by two large storms falling in a 7-day period. Flooding events of note within the area occurred in association with Hurricane Sandy (2012), Hurricane Irene (2011), Hurricane Agnes (1972), Hurricanes Connie and Diane (1955), and heavy precipitation associated with storm events in 1996, 1987, 1968, 1949, 1938, and 1936. (NOAA, 2016a)

3.6.4.1.2 Surface Water

3.6.4.1.2.1 Freshwater

There are 10 major river systems in New England: St. John, Penobscot, Kennebec, Androscoggin, St. Croix, Merrimack, Connecticut, Pawcatuck, Byram, and St. Francois (USGS, 2013f). Most of these rivers originate in mountainous forested areas. Their headwaters are often fast-flowing, cobble and boulder bottom streams and are regulated by upstream lakes, reservoirs, flood-control dams, and (or) power plants (Ayotte & Robinson, 1997).

New England also contains many natural lakes and ponds, some of which dams control. The largest are Moosehead Lake in Maine and Lake Winnipesaukee in New Hampshire. Cape Cod has no major streams yet has more than 350 lakes and ponds. (Ayotte & Robinson, 1997) Approximately 50 percent of the lakes are human-made reservoirs, some of which serve as flood control and hydropower generation (EPA, 2009). Many reservoirs were created for sawmills in the 18th and 19th centuries. When logs needed to be stored for long time, it was best to keep them wet to avoid deterioration by insects, fungal stain, and decay.

Estuarine and Coastal
New England has 20 estuarine systems, encompassing over 2,046 square miles of water surface, including Narragansett Bay, the largest estuary in the watershed. New England estuaries usually are small, deep, and well flushed by tides, with relatively small watersheds. In the northern part of the watershed, the coastal shoreline consists mainly of drowned river valleys characterized by numerous small bays, rocky shorelines, wave-cut cliffs, and large, rocky islands. The southern part consists of drowned river valleys characterized by cobble, gravel, and sand beaches, and extensive tidal marshes. (Hapke, Himmelstoss, Kratzmann, List, & Thieler, 2010)

3.6.4.1.2.2 Surface Water Quality

3.6.4.1.2.2.1 <u>Freshwater</u>
Approximately one-half of the 50,000 miles of rivers and streams in the New England watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include aesthetics, drinking water supply, aquatic life, fish consumption, fishing, navigation, and primary and secondary contact recreation. The top three causes of impairment are mercury, pH, and pathogens (the presence of *Escherichia coli* and other fecal coliform bacteria can indicate the potential presence of pathogens). The top three probable sources for impairment are nonpoint source pollution (caused by rainfall or snowmelt runoff moving over or through the ground), municipal discharges/sewage, and urban-related runoff. (EPA, 2013d)

Approximately 350,000 of the estimated 1,563 square miles of lakes, reservoirs, and ponds assessed in the area are impaired. Designated uses of the impaired lakes, reservoirs, and ponds, include aesthetics, aquatic life, fish consumption, primary and secondary contact recreation, and public drinking water supply. The top three causes of impairment are mercury, exotic aquatic plants, and nutrients such as phosphorus. The top three probable sources for impairment are atmospheric deposition, introduction of non-native organisms, and hydromodification (stream modification/damming/flow alteration). (EPA, 2013d)

3.6.4.1.2.2.2 <u>Estuarine and Coastal</u>
The overall condition of New England's coastal waters is fair, with pockets of poor water quality in Great Bay, NH, and Narragansett Bay, RI. Clean sediments with low levels of chemical contamination, an absence of acute toxicity, and moderate-to-low levels of sediment total organic carbon are in most of the region. Good water quality conditions prevail in the well-mixed, open estuaries of the Gulf of Maine, whereas the poorly flushed and highly settled estuaries south of Cape Cod are more susceptible to

eutrophication.[42] Major sources of nutrients to New England coast waters are wastewater treatment discharges, urban runoff, septic tank failures, and atmospheric deposition. Worsening conditions due to increased nutrient loads are expected in Boston Harbor, Great Bay, Plum Island Sound, and Cape Cod Bay. (EPA, 2012c)

3.6.4.1.3 Wild and Scenic Rivers

Within New England, there are 8 Wild and Scenic River designations (1 in Maine, 2 in New Hampshire, 3 in Massachusetts, and 2 in Connecticut) totaling 317 miles. There are 95 miles of river classified as wild, 123 miles classified as scenic, and 99 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.1.4 Groundwater

Consolidated bedrock aquifers made up of carbonate rocks, sandstone, and crystalline rocks occur in the eight states of the New England watershed (Figure 3-15). There are currently 16 designated SSAs in New England (EPA, 2008a). The most productive and widely used aquifers are part of the surficial aquifer system and consist of deposits of sand and gravel which, for the most part, are individual valley-fill deposits of melted glaciers. Although these aquifers are the least productive of the major aquifers in the New England watershed, they are important sources of domestic water supplies in areas where the other aquifer systems are not present (Kenny, et al., 2014). There are no areas of notable groundwater level decline within the New England watershed (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.1.4.1 Groundwater Quality

Studies in New England have identified contamination of some private wells from various chemicals (e.g., methyl-tertiary-butyl ether, radon, and arsenic). All of the States within the New England watershed recommend periodic testing for water quality of private wells. (EPA, 2011a) (New Hampshire Department of Environmental Services, 2011)

3.6.4.2 Mid-Atlantic (02)

HUC-2 Mid-Atlantic (02) includes the watersheds that discharge into: (a) the Atlantic Ocean within and between New York and Virginia; (b) Long Island Sound south of the New York-Connecticut State line; and (c) the Riviere Richelieu, a tributary of the St. Lawrence River. The Mid-Atlantic watershed includes all of Delaware and New Jersey and DC, and parts of Connecticut, Maryland, Massachusetts, New York, Pennsylvania, Vermont, Virginia, and West Virginia (USGS, 2013f). Parts of FEMA Regions I, II, and III are within this watershed.

3.6.4.2.1 Floodplains

The Mid-Atlantic watershed's floodplains are shaped by topography and intensive human alteration. They predominantly receive floodwaters during winter and spring as result of precipitation and snowmelt (USGS, 2001a). Along the coastal plain, floodplains are wide forested areas that may flood annually

[42] Eutrophication is the process where a body of water acquires a high concentration of nutrients, especially phosphates and nitrates, which can lead to excessive growth of algae (USGS, 2014l).

(Hupp, Noe, & Schenk, 2010). The Susquehanna River Basin in New York, Pennsylvania, and Maryland, is one of the most flood-prone areas in the nation (Susquehanna River Basin Commission, 2001).

Flooding events of note within the Mid-Atlantic have occurred during Hurricane Sandy (2012), Hurricane Irene (2011), Tropical Storm Lee (2011), Hurricane Ivan (2004), Hurricane Eloise (1975), Hurricane Agnes (1972), Hurricanes Connie and Diane (1955), and other heavy rainfall events (1996, 2005, 2006, and 2011) (National Weather Service, 2012a).

3.6.4.2.2 Surface Water

3.6.4.2.2.1 Freshwater

There are eight major river systems in the Mid-Atlantic, which meander through flat topographies and empty into extensive estuary systems: Riviere Richelieu, Hudson, Popolopen Brook, Manasquan, Delaware, Susquehanna, Pocomoke, and Potomac (USGS, 2013f). Most of the lakes within the Mid-Atlantic are human-made; the topography of low hills coupled with large river systems enabled reservoir development. Along the coastal plain, several regional specific lake types occur including the New Jersey Pine Barren ponds. (EPA, 2009)

3.6.4.2.2.2 Estuarine and Coastal

The Mid-Atlantic includes two of the largest estuaries in the United States—Delaware Bay and Chesapeake Bay—and 20 minor estuaries, encompassing more than 8,996 square miles of water surface. Fed by 50 major rivers and streams, the Chesapeake Bay is 200 miles long, is the largest estuary in North America, and the 3rd largest in the world. (Chesapeake Bay Foundation, 2012)

3.6.4.2.2.3 Surface Water Quality

3.6.4.2.2.3.1 Freshwater

Approximately one-third of the 150,000 miles of rivers and streams in the Mid-Atlantic that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fisheries, fish consumption, hydrology, navigation, public water supply, recreation, industrial water supply, and wildlife. The top three causes of impairment are pathogens, nutrients, and mercury. The top three probable sources for impairment are urban runoff, municipal discharges/sewage, and agriculture. (EPA, 2013d)

Approximately three-quarters of the more than 781 square miles (excluding Pennsylvania) of lakes, reservoirs, and ponds assessed in the area are impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, drinking water supply, fish consumption, hydrology, industrial water supply, navigation, recreation, and wildlife. The top three causes of impairment are nutrients, PCBs, and mercury. The top three probable sources for impairment are atmospheric deposition, agriculture, and nonpoint source pollution. (EPA, 2013d)

3.6.4.2.2.3.2 Estuarine and Coastal

Most of the estuaries in the Mid-Atlantic are considered to be highly eutrophic and more than half the systems in this region have impacts to living resources. Causes of impairments include agriculture (crops and animal operations), wastewater treatment, urban runoff, atmospheric deposition, onsite septic tanks, and combined sewer overflow. Under the CWA, the Chesapeake Bay is listed as an impaired waterway. (EPA, 2012c)

3.6.4.2.3 Wild and Scenic Rivers

Within the Mid-Atlantic watershed, there are 7 Wild and Scenic River designations in 4 states (1 in Delaware and Pennsylvania, 5 in New Jersey, and 1 in New York and Pennsylvania) totaling 568 miles. There are 178 miles of river classified as scenic and 390 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.2.4 Groundwater

Unconsolidated and semi-consolidated sand and gravel aquifers occur throughout the northern half of the Mid-Atlantic watershed; sandstone and carbonate-rock aquifers, sand and gravel aquifers, sandstone aquifers, carbonate-rock aquifers, and crystalline-rock aquifers are also present (as shown in Figure 3-15). There are currently 18 designated SSAs in the Mid-Atlantic (EPA, 2007a) (EPA, 2010a). The USGS study, *Groundwater Depletion in the United States (1900–2008),* identified minor aquifer level depletion within the Mid Atlantic watershed (Konikow, 2013). Water levels in many of the confined sand and gravel aquifers have been declining by up to 2 feet per year, resulting in total declines of tens to hundreds of feet from their original levels (Masterson, Pope, Monti Jr, & Nardi, 2011).

3.6.4.2.4.1 Groundwater Quality

Nitrate and pesticide contamination of groundwater from agricultural applications has been documented by the USGS in several aquifers of the watershed (Debrewer, Ator, & Denver, 2008).

3.6.4.3 South Atlantic-Gulf (03)

The HUC-2 South Atlantic-Gulf (03) watershed drains to the Atlantic Ocean within and between Virginia and Florida, and to the Gulf of Mexico within and between Florida and Louisiana (USGS, 2013f). Parts of FEMA Regions III, IV, and VI are within this watershed.

3.6.4.3.1 Floodplains

Most of the South Atlantic-Gulf watershed is within the coastal plain, where floodplains are wide forested areas that may flood annually (Hupp, Noe, & Schenk, 2010). Throughout hilly parts of the area, floodplains are relatively small due to steeper topography, which increases the chance of flash flooding. Floodplains predominantly receive floodwaters during the spring, summer, and fall seasons (USGS, 2001a). Several large areas of development, such as the Atlanta metro area and south Florida, experience urban drainage problems since there are little to no natural floodplains remaining (FEMA, Undated).

The South Atlantic-Gulf watershed is subject to tropical storms and hurricanes. More than 40 hurricanes, tropical storms, and heavy rainfall events have occurred within the South Atlantic Gulf since 1979, resulting in significant flooding. Most recent significant events include Hurricanes Isaac and Sandy (2012), Tropical Storm Debby (2012), Hurricane Irene (2011), Tropical Storm Lee (2011), and Hurricane Gustav (2008). (FEMA, 2013d)

3.6.4.3.2 Surface Water

3.6.4.3.2.1 Freshwater

There are 22 major river systems in the South Atlantic Gulf watershed: Roanoke, Neuse, Cape Fear, Santee, Savannah, Altamaha, St. John's, Caloosahatchee, Kissimmee, Peace, Withlacoochee, Suwannee, Aucilla, Ochlockonee, Apalachicola, Choctawhatchee, Escambia, Alabama, Mobile, Tombigbee, Pascagoula, and Pearl (USGS, 2013f). Channelization and dams have altered the natural courses of rivers throughout the area, which has both controlled and exacerbated flood events. Major lakes include South Carolina's Lake Marion and Florida's Lake Okeechobee. Notable regional lakes include southeastern blackwater lakes, coastal Carolina "bays," and the clear limestone lakes of north Florida. (EPA, 2009)

3.6.4.3.2.1.1 Estuarine and Coastal
The area includes 40 estuary systems, encompassing more than 9,653 square miles of water surface. The South Atlantic-Gulf coast consists of five regions:

1. Virginia, North Carolina, and northern South Carolina shoreline—composed of long barrier and mainland beaches (including the Outer Banks and the South Carolina Grand Strand region);
2. Region extending from Charleston, SC, to the St. Johns River entrance at Jacksonville, FL—a tide-dominated coast composed of numerous short barrier islands, separated by large tidal inlets and backed by wide expanses of tidal marsh;
3. East Coast of Florida—composed of barrier and mainland beaches backed by narrow bays and rivers;
4. Eastern Gulf coast from southwest Florida to the Mississippi River—composed of low-lying sandy barrier islands south of Tarpon Springs, FL, and west of St. Marks, FL, with a marsh-dominated coast in between in the Big Bend area of Florida; and
5. Unrestricted open bays, semi-enclosed lagoons, tidal marshes, and delta complexes in the Gulf of Mexico. (FEMA, 2010)

3.6.4.3.2.2 Surface Water Quality

3.6.4.3.2.2.1 Freshwater
Approximately half of the 70,000 miles of rivers and streams in the South Atlantic-Gulf that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fish consumption, fisheries, potable water supply, and recreation. The top three causes of impairment are pathogens, low dissolved oxygen, and mercury. The top three sources for impairment are nonpoint source pollution, agriculture, and urban-related runoff. (EPA, 2013d)

Approximately half of the estimated 3,906 square miles of lakes, reservoirs, and ponds assessed in the South Atlantic-Gulf watershed are impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, drinking water supply, fish consumption, recreation, and wildlife. The top three causes of impairment are nutrients, mercury, and PCBs. The top three probable sources for impairment are contaminated sediments, atmospheric deposition, and hydromodification. (EPA, 2013d)

3.6.4.3.2.2.2 Estuarine and Coastal
Increasing population growth in this region of the United States has contributed to estuarine water quality degradation in the South Atlantic Gulf. Sediment, water quality, and coastal habitat are in fair shape by the EPA (EPA, 2012c). North and South Carolina have high densities of permitted discharges and the

highest density of Concentrated Animal Feeding Operations (CAFOs), with approximately 6.5 CAFOs per 100 square miles within South Carolina (South Carolina Department of Natural Resources, 2005). The large concentrations of nitrogen and phosphorus runoff from streams combined with limited dilution in some of the smaller estuaries are partly responsible for EPA's rating (EPA, 2012c).

Water quality in the coastal waters extending from the Mississippi River Delta to Tampa Bay, is influenced primarily by riverine discharges and coastal runoff. It is also influenced by the warm Loop Current, which irregularly intrudes into the Gulf of Mexico causing the water column to rapidly change from being well mixed to separated. Mississippi River discharges can be easily pulled into the Loop Current. In 2005, Hurricane Katrina and Hurricane Rita greatly increased in strength when they passed over the warmer waters of the Loop Current. (EPA, 2012c)

3.6.4.3.3 Wild and Scenic Rivers

Within the South Atlantic-Gulf watershed, there are 8 Wild and Scenic rivers designations in 6 states (1 in Alabama; 1 in Mississippi; 1 river flows through North Carolina, South Carolina, and Georgia; 2 in Florida; and 3 in North Carolina), totaling 269 miles. There are 115 miles of river classified as wild, 123 miles classified as scenic, and 31 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.3.4 Groundwater

The South Atlantic-Gulf watershed contains carbonate-rock aquifers, surficial and coastal lowlands unconsolidated and semi-consolidated sand and gravel aquifers, and sandstone aquifers, and crystalline-rock aquifers, as shown in Figure 3-15. There are two designated SSAs in the South Atlantic-Gulf watershed (EPA, 2013e). The surficial aquifers systems on the coasts of South Carolina and Georgia and the Floridian aquifer system in southwest Florida are areas of notable groundwater level decline within the watershed (Campbell & Coes, 2010). The Floridian aquifer system is the primary source of drinking water for nearly 10 million people, supports water needs for agriculture, industry, and tourism throughout most of the southeastern coastal region, and is susceptible to saltwater intrusion due to over-extraction, storm events, and sea level rise (USGS, 1994) (NOAA, 2013a) (USGS, 2011b).

3.6.4.3.4.1 Groundwater Quality

Pesticides and volatile organic compounds (VOCs) have been detected in many public supply wells in the South Atlantic Gulf's aquifers, but concentrations are seldom high enough to affect human health. In some areas, water in the Floridian aquifer is not suitable for drinking without some type of chemical treatment because it contains various minerals or salts. (USGS, 2011b)

3.6.4.4 Great Lakes (04)

The HUC-2 Great Lakes (04) watershed drains to the Great Lakes and St. Lawrence River. The area includes parts of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin (USGS, 2013f). Parts of FEMA Regions II, III, and V are within the Great Lakes watershed.

3.6.4.4.1 Floodplains

In the Great Lakes watershed, floodplains usually receive floodwaters during winter and spring (USGS, 2001a). The natural communities of these floodplains are predominantly lowland hardwoods along large rivers. These floodplain systems are produced and maintained by channel meandering, sedimentation, and erosion caused by natural hydrological variation. Regrowth of the dominant species (cottonwood and willow) is dependent on flooding and movement of river channels, which creates bare, moist soil needed for seedling establishment. (USFS, 2005)

Flooding events of note have occurred in association with rain events that have caused high lake levels and subsequent flooding (1973, 1975, 1985, 1986, 1987, 1996, 1997, 2008, and 2013) (FEMA, 2011a) (FEMA, 2013d).

3.6.4.4.2 Surface Water

3.6.4.4.2.1 Freshwater

The Great Lakes—Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario—are a series of connected, freshwater lakes situated between the United States and Canada. The lakes are the largest system of fresh, surface water on earth, spanning 750 miles from west to east and containing approximately 21 percent of the world's and 84 percent of North America's freshwater supply. The Great Lakes have 10,000 miles of shoreline and 95 percent of the Nation's fresh surface water. The Great Lakes cover approximately 295,000 square miles, with nearly 11,000 miles of shoreline, and holds 5,500 cubic miles of water (USFWS, 2007a). The topography around the lakes is relatively flat, with low hills sculpted by glacial activity. Streams and rivers drain small areas directly into the Great Lakes. There are 17 major river systems: Montreal, Carp, Milwaukee, Manistique, St. Joseph, Grand, Au Sable, St. Clair, Detroit, Huron, Vermilion, Ashtabula, Niagara, Genesee, Stony Creek, St. Lawrence, and English (USGS, 2013f). Tens of thousands of smaller lakes also occur within the landscape.

3.6.4.4.2.2 Estuarine and Coastal

The Great Lakes ecosystem features an extensive watershed with 5,000 tributaries, more than 1,000 miles of shoreline, and some 35,000 islands. This watershed includes a broad range of habitats, from the coniferous forests and rocky shorelines of Lake Superior to the fertile soils and sandy shores of Lake Michigan and Lake Erie. The coastal ecosystems of the Great Lakes include about 30,000 islands, wetlands, coastal marshes, sand dunes, savannas, prairies, and alvars (grassland, savanna and sparsely vegetated rock barrens that develop on flat limestone or dolostone bedrock where soils are very shallow). (USFWS, 2007a)

The St. Louis estuary is the largest estuary in the Great Lakes, supporting a wide variety of fish and wildlife resources. The upper portions of the watershed are forested, with mining and some agricultural development. The middle portions include boggy wetlands associated with the river system. The estuary is lacustrine (freshwater) habitat behind two large sand bars that protect the estuary from Lake Superior. (USFWS, 2007a)

3.6.4.4.2.3 Surface Water Quality

3.6.4.4.2.3.1 Freshwater

Approximately three-quarters of the 100,000 miles of rivers and streams in the Great Lakes that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include aquatic life, fisheries, fish consumption, hydrology, public water supply, recreation, and wildlife. The top three causes of impairment are polychlorinated biphenyls (PCBs), mercury, and habitat alterations. The top three probable sources for impairment are atmospheric deposition, agriculture, and hydromodification. (EPA, 2013d)

Approximately three-quarters of the more than 1,563 square miles of lakes, reservoirs, and ponds assessed in the Great Lakes area are impaired. Designated uses of the impaired surface waters include aquatic life, fisheries, fish consumption, hydrology, public water supply, and recreation. The top three causes of impairment are mercury, PCBs, and nutrients. The top three probable sources for impairment are atmospheric deposition, nonpoint source pollution, and contaminated sediments. (EPA, 2013d)

Poor sediment quality, primarily resulting from land-based anthropogenic influences, is a major problem in the Great Lakes. Toxic and persistent chemicals have accumulated in Great Lakes sediments because of discharges from maritime activities, industrial facilities and sewer overflows, and from urban and agricultural runoff. The highest levels of sediment contamination generally are in urban harbors, bays, and river mouths along the Great Lakes. The EPA reported that sediment is the largest source of contaminants in harbors of the Great Lakes. Concern regarding sediment quality in the past has focused on shoreline areas because sediment contamination is more noticeable and measurable there than it is in deeper, offshore locations. (Great Lakes Science Advisory Board to the International Joint Commission, 2010) (EPA, 2012c)

3.6.4.4.2.3.2 Estuarine and Coastal

In spite of their large size, the Great Lakes are sensitive to the effects of a wide range of pollutants. Major stresses on the lakes include toxic and nutrient pollution, invasive species, and habitat degradation. Sources of pollution include the runoff of soils and farm chemicals from agricultural lands, waste from cities, discharges from industrial areas and leachate from disposal sites. Outflows from the Great Lakes are relatively small (less than 1 percent per year) in comparison with the total volume of water, stay within the system, and become more concentrated with time. (EPA, 2012c)

3.6.4.4.3 Wild and Scenic Rivers

Within the Great Lakes watershed, there are 17 Wild and Scenic Rivers designations in 2 states (16 in Michigan and 1 in Wisconsin) totaling 682 miles. There are 83 miles of river classified as wild, 311 miles classified as scenic, and 288 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.4.4 Groundwater

The Great Lakes watershed contains sandstone aquifers, sandstone and carbonate-rock aquifers, carbonate-rock aquifers, and unconsolidated and semi-consolidated sand and gravel aquifers, as shown in Figure 3-15. There are currently five designated SSAs in the Great Lakes watershed (EPA, 2010a) (EPA, 2013f). The aquifers adjacent to the west of Lake Michigan have areas of notable groundwater level decline (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.4.4.1 Groundwater Quality

Fecal pollution and microbial contamination, commonly from non-point sources, continue to be one of the most frequently identified causes of impairment of Great Lakes Basin groundwater. Pathogens enter the basin ecosystem from manure and biosolids land spreading; leaking sewer infrastructure and on-site wastewater systems; landfills; cemeteries; waste and stormwater lagoons; and surface water, all of which have impacted groundwater quality within the watershed. Other specific threats to groundwater within the Great Lakes watershed include toxic chemicals (chlorinated solvents, petroleum-based products, pesticides, metals, and radionuclides), hormones, and road salt. (Great Lakes Science Advisory Board to the International Joint Commission, 2010)

3.6.4.5 Ohio (05)

The HUC-2 Ohio (05) watershed drains the Ohio River Basin, which includes parts of Illinois, Indiana, Kentucky, Maryland, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia (USGS, 2013f). Parts of FEMA Regions II, III, IV, and V are within the Ohio watershed.

3.6.4.5.1 Floodplains

Riverine flooding is the main type of flooding in the area, and the Ohio River and its tributaries have a long history of flooding (Ohio Department of Natural Resources, 2005). Floodplains within the Ohio watershed predominantly receive floodwaters during winter and spring (USGS, 2001a). Precipitation and ice jams are the main causes of flooding (West Virginia Department of Homeland Security and Emergency Management, Undated(a)). Dams built for flood control and navigation have altered the natural course of the Ohio River (Tennessee Valley Authority, 2013). Alluvial fans occur within mountain valleys of Kentucky, Tennessee, and West Virginia (FEMA, Undated).

Flooding events of note within the Ohio watershed have occurred in association with Hurricane Katrina and Rita (2005); Hurricanes Frances, Ivan, and Jeanne (2004); Tropical Storm Isadore (2002); and other heavy rainfall events (1978, 1984, 1993, 1996, 1997, 2008, 2010, and 2011) (FEMA, 2013d).

3.6.4.5.2 Surface Water

Surface waters in this region include more than 50,000 miles of rivers and streams and 1,300 lakes (USACE, 2009a). There are 16 major river systems: Allegheny, Monongahela, Kanawha, Muskingum, Scioto, Big Sandy, Guyandotte, Great Miami, Licking, Kentucky, Green, Wabash, Patoka, White, Cumberland, and Ohio (USGS, 2013f). Lakes within the watershed are a mixture of natural and human-made lakes and reservoirs (EPA, 2009).

3.6.4.5.2.1 Surface Water Quality

Fifty percent of the 100,000 miles of rivers and streams in the Ohio watershed that have been assessed for water quality are designated as impaired. Designated uses of impaired surface waters include aquatic life, fisheries, fish consumption, habitats, public water supply, and recreation. The top three causes of impairment are sediment, habitat alterations, and nutrients. The top three probable sources for impairment are nonpoint source pollution, agriculture, and municipal discharges/sewage. (EPA, 2013d)

Approximately half of the estimated 1,094 square miles of lakes, reservoirs, and ponds assessed in the Ohio watershed are impaired. Designated uses of the impaired surface waters include aesthetics, agriculture, aquatic life, fish consumption, public water supply, recreation, and wildlife. The top three causes of impairment are mercury, PCBs, and nutrients. The top three probable sources for impairment are nonpoint source pollution, atmospheric deposition, and contaminated sediments. (EPA, 2013d)

3.6.4.5.3 Wild and Scenic Rivers

Within the Ohio watershed, there are 9 Wild and Scenic Rivers designations in 6 states (1 in Illinois, Kentucky, North Carolina, and West Virginia, 3 in Ohio, and 2 Pennsylvania) totaling 424 miles. There are 9 miles of river classified as wild, 218 miles classified as scenic, and 197 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.5.4 Groundwater

The Ohio watershed contains sandstone aquifers, sandstone and carbonate-rock aquifers, carbonate-rock aquifers, and unconsolidated and semi-consolidated sand and gravel aquifers as shown in Figure 3-15. A key feature of the basin's hydrology is the presence of numerous underground aquifers that provide substantial sources of groundwater throughout the region. Two designated SSAs are in the Ohio watershed (EPA, 2010a) (EPA, 2013f). There are no areas of notable groundwater level decline within the Ohio watershed (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.5.4.1 Groundwater Quality

Generally, groundwater resources are adequate for low-density rural residential use, but due to iron content and other groundwater quality issues in well water, public service districts are required to provide potable water in many rural areas of the watershed. Threats to groundwater include contamination by wastewater treatment facilities (septic systems and inadequate treatment plants), hazardous and toxic waste sites, minerals extraction processes, dewatering through excavation, leaking underground storage tanks (petroleum and other stored materials), acid mine drainage, pesticides and herbicides, landfills, injection wells, impervious material placement, and many others within the area. (USACE, 2009a)

3.6.4.6 Tennessee (06)

The HUC-2 Tennessee (06) watershed encompasses the Tennessee River watershed and includes much of Tennessee as well as parts of Kentucky, Mississippi, Alabama, Georgia, North Carolina and Virginia (USGS, 2013f). FEMA Regions III and IV are partially within the watershed.

3.6.4.6.1 Floodplains

Floodplains within the area predominantly receive floodwaters during spring, summer, and fall (USGS, 2001a). Dams with the primary intent of flood control have altered the Tennessee River (Tennessee Valley Authority, 2013). Alluvial fans occur within mountain valleys of Tennessee (FEMA, Undated).

Floodplain forests within the eastern part of the area have slight vegetation differences depending on the floodplain landforms (North Carolina Department of Environment and Natural Resources, 2010).

Flooding events of note within the Tennessee watershed have occurred in association with Tropical Storm Lee (2011), Hurricane Katrina (2005); Hurricanes Frances, Ivan, and Jeanne (2004); Hurricane Isadore (2002); and other heavy rainfall events (1973, 2009, 2010, and 2011) (FEMA, 2013d).

3.6.4.6.2 Surface Water

The Tennessee watershed is dominated by the Tennessee River and its numerous reservoirs. Clear mountain streams are scattered through the southern Appalachian Mountains where the majority of land is publicly owned and protected (EPA, 2013g). There are six major river systems: French Broad, Holston, Sequatchie, Hiwassee, Elk, and Tennessee (USGS, 2013f). Several large reservoirs were created by damming the Tennessee River such as Watts Bar Lake, Chickamauga Lake, Guntersville Lake, Wheeler Lake, Pickwick Lake, and Kentucky Lake. These lakes were established for flood control, recreation, public water supply, and power generation (EPA, 2009).

During the last 80 years, the natural free-flowing character of the Tennessee River has been greatly altered by constructing 49 dams along the main stem and tributaries. The primary function of dams along the main stem is to improve river navigation and generate hydroelectric power; whereas dams on the tributaries function as large storage impoundments used primarily for flood control. Other alterations within this watershed include the joining of the Mobile and Tennessee Rivers via the Tennessee-Tombigbee Waterway, which provides a navigational route between the Mobile and Tennessee Rivers and the Gulf of Mexico. (USGS, 2001b)

3.6.4.6.3 Surface Water Quality

Resource depletion and agriculture in the western part of the region contribute erosion and runoff to the surface waterbodies. Approximately one-third of the 20,000 miles of rivers and streams in the HUC-2 Tennessee (06) area that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic habitat, aquatic life, fishing, fish consumption, public water supply, and recreation. The top three causes of impairment are pathogens, sediment, and habitat alterations. The top three probable sources for impairment are agriculture, urban-related runoff, and hydromodification. (EPA, 2013d)

Approximately one-quarter of the estimated 625 square miles of lakes, reservoirs, and ponds assessed in the Tennessee watershed are impaired. Designated uses of the impaired surface waters include aquatic life, fishing, fish consumption, public water supply, and recreation. The top three causes of impairment are PCBs, mercury, and low dissolved oxygen. The top three probable sources for impairment are contaminated sediments, atmospheric deposition, and industrial sources. (EPA, 2013d)

3.6.4.6.4 Wild and Scenic Rivers

The Obed River is the only Wild and Scenic Rivers designation within the area; it has 43 miles of river classified as wild and 2 miles classified as recreational (National Wild and Scenic Rivers System, 2016).

3.6.4.6.5 Groundwater

The Tennessee watershed contains sandstone aquifers, carbonate-rock aquifers, sandstone and carbonate-rock aquifers, and crystalline-rock aquifers (Figure 3-15). There are no designated SSAs within this watershed (EPA, 2007a) (EPA, 2013e). There are no areas of notable groundwater level decline within the area (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.6.5.1 Groundwater Quality

Carbonate rock formations are the most productive aquifers in the Tennessee River Basin, while also being the most susceptible to contamination. These aquifers typically meet all Federal and State drinking-water standards with the exceptions of nitrate and bacteria. Based on a water quality assessment conducted between 1994 and 1998 by the USGS National Water-Quality Assessment Program, nitrate concentrations in domestic wells and springs used as drinking water sources were within drinking water standards and guidelines. Levels of nitrate exceeding drinking water standards were detected only in shallow agricultural monitoring wells. Numerous pesticides and VOCs were detected in wells and springs, but none exceeded drinking water standards. (Hampson, Johnson, Ahlstedt, & Connell, 2000)

3.6.4.7 Upper Mississippi (07)

The HUC-2 Upper Mississippi (07) watershed includes the Mississippi River Basin above the confluence with the Ohio River, and includes parts of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, South Dakota, and Wisconsin (USGS, 2013f). Parts of FEMA Regions V, VII, and VIII are within the watershed.

3.6.4.7.1 Floodplains

The Upper Mississippi River watershed is a major sub-basin of the Mississippi River Basin, the largest floodplain river ecosystem in North America and the 3rd largest of 79 such river systems in the world. Floodplains within the area predominantly receive floodwaters during winter and spring (Serpi & Baumann, 1996). Agriculture has altered much of the floodplains along the Mississippi River and its tributaries. Two hundred years ago, forests occupied almost 75 percent of the floodplain; in 2010, forests occupied approximately 18 percent of the area. Construction of levees and locks and dams have separated the river from half its floodplain, and transformed 655-miles of the Mississippi and 323-miles of the Illinois from free-flowing rivers to a series of pools. (USFS, 2011)

Flooding events of note within the area have occurred in association with heavy rainfall events (1982, 1993, 2008, 2011, and 2013) (FEMA, 2013d).

3.6.4.7.2 Surface Water

The Upper Mississippi River is 800 miles long, and runs between Lake Itasca in northern Minnesota, to the Ohio River at the southern tip of Illinois. The watershed encompasses nearly 189,000 square miles of land area that drains to the Lower Mississippi River at Cairo, IL (USFS, 2011). The area is predominantly rolling hills and small lakes. There are 13 major river systems: Minnesota, St. Croix, Root, La Crosse, Chippewa, Wisconsin, Iowa, Rock, Des Moines, Illinois, Fox, Kaskaskia, and Mississippi (USGS, 2013f).

3.6.4.7.2.1 Surface Water Quality

This area has been heavily altered by early timber operations and agriculture, which have reduced riparian areas (EPA, 2013g). Problems for surface water include runoff, erosion, and pollution. Approximately three-quarters of the 35,000 miles of rivers and streams in the Upper Mississippi watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include aquatic life, fisheries, fish consumption, public water supply, and recreation. Sediment, nitrogen, and phosphorus are the primary pollutants of concern in the Upper Mississippi River watershed. (EPA, 2013d) A substantial portion of the pollutants comes from human activities: surface runoff from agricultural practices, discharge from sewage treatment and industrial wastewater plants, and stormwater runoff from city streets (USFS, 2011).

Almost all of the estimated 3,906 square miles of lakes, reservoirs, and ponds assessed in the Upper Mississippi watersheds are impaired. Designated uses of the impaired surface waters include aesthetics, aquatic life, fisheries, fish consumption, public water supply, and recreation. The top three causes of impairment are mercury, PCBs, and algal growth. The top three probable sources for impairment are atmospheric depositions, nonpoint source pollution, and contaminated sediments. (EPA, 2013d)

3.6.4.7.3 Wild and Scenic Rivers

Within the Upper Mississippi watershed, there is one Wild and Scenic River designation in Minnesota and Wisconsin. The St. Croix River flows in Minnesota and Wisconsin totaling 252 miles, 193 miles are classified as scenic, and 59 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.7.4 Groundwater

The Upper Mississippi watershed contains sandstone aquifers, sandstone and carbonate-rock aquifers, and unconsolidated and semi-consolidated sand and gravel aquifers (as shown in Figure 3-15). There is one designated SSA in the watershed (EPA, 2013f) (EPA, 2013h). The aquifers throughout Iowa are areas of notable groundwater level decline (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.7.4.1 Groundwater Quality

In this watershed, shallow groundwater (less than 50 feet below land surface) contains pesticides, nutrients, and industrial chemicals and detectable concentrations of numerous VOCs. Deeper groundwater sources, typically used for public supply, have been found to contain pesticides, and lower nitrate concentrations. However, with the exception of naturally occurring radon, deep groundwater resources meet drinking water standards and guidelines for most chemicals. (Stark, et al., 2000)

3.6.4.8 Lower Mississippi (08)

The HUC-2 Lower Mississippi (08) watershed is the Mississippi River basin below the confluence with the Ohio River, and the coastal Pearl River basin. The watershed includes parts of Arkansas, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee that border the Mississippi River (USGS, 2013f). Parts of FEMA Regions IV, VI, and VII are within the watershed.

3.6.4.8.1 Floodplains

Floodplains within the Lower Mississippi watershed predominantly receive floodwaters during late summer and fall (USGS, 2001a). Much of the area has been cleared for agriculture but swamps and bottomland hardwood forests cover large areas. This watershed is also characterized by levees and floodways directing floodwaters. (Mac, Opler, Haecker, & Doran, 1998)

The Lower Mississippi watershed drains to most of Louisiana's 15,000 miles of shoreline and 8,200 square miles of coastal zone. Within the watershed, coastal development pressure is intense, with major urban cities in need of new transportation and infrastructure following the devastation caused by Hurricane Katrina. The USACE has developed a series of projects under the Mississippi Coastal Improvement Program to build flood defenses along the coast to resist hurricane storm surge and waves and protect community residents. Further inland of the coast, communities are seeing increased development as residents move inland to avoid damaging hurricanes, which places additional pressure on natural resources and in some cases decreases floodplain storage capacity. Some urbanized areas are constructing flood protection measures with dikes, floodwalls, and levees to mitigate potential flood damages from both river and coastal flooding. (Mississippi Department of Marine Resources, 2010)

Flooding events of note within the watershed have occurred in association with Hurricane Isaac (2012), Tropical Storm Lee (2011), Hurricanes Gustav and Ike (2008), Hurricanes Katrina and Rita (2005), Hurricane Lili (2002), Tropical Storm Allison (2001), and other heavy rainfall events (2010, and 2011). (FEMA, 2013d)

3.6.4.8.2 Surface Water

3.6.4.8.2.1 Freshwater

The Mississippi River dominates the Lower Mississippi watershed. The topography is predominantly flat with historical floodplains now used for agriculture. Many of these areas have been ditched and drained, vastly altering the natural hydrology. Human-made levee systems are common along waterways. Remnant natural levees, oxbow lakes, and extensive backwater systems are prevalent. Loess bluffs (i.e., wind-created sediment deposits) dominate the topography outside the floodplains. (Mac, Opler, Haecker, & Doran, 1998). There are 14 major river systems: Hatchee, St. Francis, Yazoo, Ouachita, Boeuf, Tensas, Big Black, Homochitto, Lower Red, Atchafalaya, Lower Grand, Calcasieu, Pearl, and Mississippi (USGS, 2013f). The rivers are relatively shallow with sandy bottoms. Numerous reservoirs occur within the Lower Mississippi watershed (EPA, 2009).

3.6.4.8.2.2 Estuarine and Coastal

Wide, marshy areas and a low-lying coastal plain characterize the Lower Mississippi area. This coastal environment consists of shallow lagoonal estuaries, small bays, extensive tidal marshes, and drowned river valleys. Farther inland are a wide variety of marsh types, including nearly 109 square miles of salt and brackish marshes, and salt pannes (shallow depressions with high salt concentrations). (EPA, 2010b)

3.6.4.8.2.3 Surface Water Quality

3.6.4.8.2.3.1 <u>Freshwater</u>
Approximately one-half of the 20,000 miles of rivers and streams in the Lower Mississippi watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fisheries, fish consumption, public water supply, recreation, and wildlife. The top three causes of impairment are low dissolved oxygen, sediments, and mercury. The top three probable sources for impairment are nonpoint source pollution, agriculture, and atmospheric deposition. (EPA, 2013d)

Nearly all of the estimated 781 square miles of lakes, reservoirs, and ponds assessed in the Lower Mississippi watershed are impaired. Designated uses of the impaired surface waters include aquatic life, fisheries, fish consumption, public water supply, and recreation. The top three causes of impairment are mercury, exotic species, and turbidity. The top three probable sources for impairment are nonpoint source pollution, atmospheric deposition, and agriculture. (EPA, 2013d)

3.6.4.8.2.3.2 <u>Estuarine and Coastal</u>
The Mississippi River drains 41 percent of the continental United States, 31 States, and 2 Canadian Provinces, totalling about 1.8 million square miles. At a discharge rate of 600,000 cubic feet per second near New Orleans, the river accounts for nearly 90 percent of the freshwater discharge into the Gulf of Mexico. That flow moves as much as 159 million tons of sediment a year down the river. (Mississippi Department of Environmental Quality, 2008) Most water quality concerns are related to mercury contamination, pathogens, or dissolved oxygen, and the top suspected sources of impairment are atmospheric deposition, unknown sources, and upstream sources. (Louisiana Department of Environmental Quality, 2014)

3.6.4.8.3 Wild and Scenic Rivers

Within the Lower Mississippi watershed, there is one Wild and Scenic River designation in Arkansas. The Little Missouri River is designated for 15 miles; 4 miles classified as wild and 11 miles classified as scenic. (National Wild and Scenic Rivers System, 2016)

3.6.4.8.4 Groundwater

The Lower Mississippi watershed contains unconsolidated and semi-consolidated sand and gravel aquifers, as shown in Figure 3-15. There are currently three designated SSAs in the Lower Mississippi watershed (EPA, 2013e) (EPA, 2012d). The USGS study, *Groundwater Depletion in the United States (1900–2008),* identified severe aquifer level depletion within the watershed (Konikow, 2013). Within the middle aquifer of the Mississippi embayment aquifer system, large withdrawals have resulted in a long-term decline in water levels, which locally exceeds 100 feet, and have created cones of depression in several places. Groundwater removed from storage also has contributed to the long-term decline in water levels. Regional water-level declines of as much as 70 feet have resulted in interstate concerns over continued and increased pumpage in the Memphis, TN area. (Maupin & Barber, Regional Assessment of Groundwater Quality in the Mississippi Embayment-Texas Coastal Uplands Aquifer System, Coastal Lowlands Aquifer System, and the Edwards-Trinity Aquifer System, 2005). Coastal aquifers are vulnerable to saltwater flooding due to storm surge and sea level rise (NOAA, 2013a).

3.6.4.8.4.1 Groundwater Quality

The overall quality of the groundwater supply in the area is relatively unaffected by agricultural activities. The primary sources of groundwater contamination in Mississippi typically can be traced to leaking underground storage tanks holding petroleum-based products and faulty septic systems. Another problem of note in areas of the State where petroleum exploration and production have been prevalent is localized brine (saltwater) contamination of shallow aquifers. (Kenny, et al., 2014)

3.6.4.9 Souris-Red-Rainy (09)

The HUC-2 Souris-Red-Rainy (09) sub-region includes the Lake of the Woods and Rainy, Red, and Souris River Basins, which discharge into Lake Winnipeg and Hudson Bay and includes parts of Minnesota, North Dakota, and South Dakota (USGS, 2013f). Parts of FEMA Regions V and VIII are within the Souris-Red-Rainy watershed.

3.6.4.9.1 Floodplains

The watershed receives floodwaters during winter and spring (USGS, 2001a). Stream bank overflow and localized excess water are two types of water problems within the area due to the flat topography (USGS, 1984). Many of the urban areas occur along the rivers within the floodplains of this watershed and flooding throughout this area has increased in recent years (Red River Basin Commission, 2011). Flooding events of note within the area have occurred in association with heavy rainfall and snowmelt events (1979, 1993, 1997, 2009, 2010, and 2011) (FEMA, 2013d) (Red River Basin Commission, 2011).

3.6.4.9.2 Surface Water

Souris-Red-Rainy watershed's topography is dominated by plains and low hills developed by glacial activity. Rivers and streams begin from springs or prairie potholes of the plains. The major four river systems are Souris, Red, Goose, Marsh, Sheyenne, and Rainy (USGS, 2013f). Most of the lakes within this area are natural. Prairie potholes that occur in the plains are small ponds resulting from receding glaciers. Major lakes in the forested areas include Lake of the Woods, Rainy Lake, and Red Lake in Minnesota. (EPA, 2009)

3.6.4.9.2.1 Surface Water Quality

Less than 5,000 of the 30,000 miles of rivers and streams in the Souris-Red-Rainy watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include aquatic life, fisheries, irrigation, public water supply, and recreation. The top three causes of impairment are turbidity, mercury, and pathogens. The top three probable sources for impairment are agriculture, atmospheric deposition, and habitat alterations. (EPA, 2013d)

Approximately three-fourths of the estimated 3,125 square miles of lakes, reservoirs, and ponds assessed in the Souris-Red-Rainy watershed are designated as impaired. Designated uses of the impaired surface waters include aquatic life, fish consumption, irrigation, and recreation. The top three causes of impairment are mercury, PCBs, and nutrients. The top three probable sources for impairment are atmospheric deposition, nonpoint source pollution, and agriculture. (EPA, 2013d)

3.6.4.9.3 Wild and Scenic Rivers

Within the Souris-Red-Rainy watershed, there are no Wild and Scenic Rivers designations (National Wild and Scenic Rivers System, 2016).

3.6.4.9.4 Groundwater

The Souris-Red-Rainy watershed contains sandstone aquifers and unconsolidated and semi-consolidated sand and gravel aquifers, as presented in Figure 3-15. There are no designated SSAs within the watershed (EPA, 2013f) (EPA, 2013i). The aquifers in southeast North Dakota are areas of notable groundwater level decline (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.9.4.1 Groundwater Quality

Considering the large area of agricultural cropland in the Souris-Red-Rainy watershed, pesticide detections and nitrate concentrations in groundwater are relatively low. Although the geology and semiarid climate of the western part of the Souris-Red-Rainy basin have resulted in high levels of total dissolved solids (TDS), these levels do not pose a health risk for drinking water. (Stoner, Lorenz, Goldstein, Brigham, & Cowdery, 1998)

3.6.4.10 Missouri (10)

The HUC-2 Missouri (10) watershed includes the Missouri River Basin, the Saskatchewan River Basin, and several small closed basins. The area includes all of Nebraska and parts of Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, North Dakota, South Dakota, and Wyoming (USGS, 2013f). Parts of FEMA Regions V, VII, and VIII are within this watershed.

3.6.4.10.1 Floodplains

Floodplains within the Missouri watershed predominantly receive floodwaters during winter, spring, and summer (USGS, 2001a). The Missouri River system historically flooded into large floodplains of riparian forest (Committee on Missouri River Ecosystem Science, 2002). Many of the rivers in the system have been altered to control flooding which has altered the natural environment. These changes include levees, channelization, and bank stabilization. Several stretches of rivers throughout the Missouri watershed have remnant floodplains that have not been altered. These have a twisting river channel and a wide floodplain. Within these floodplains, oxbow lakes, sand dunes, and forested areas occur. (Committee on Missouri River Ecosystem Science, 2002)

In September 2013, Boulder, CO, in the southeastern corner of the Missouri watershed, experienced a 1000-year flood event, meaning that any one year has a 1-in 1,000 chance of experiencing such heavy precipitation (NOAA, 2013b). Situated at the mouth of a canyon and adjacent to an alluvial fan, with Boulder Creek (a tributary to the Platte River) flowing through the town's center, Boulder is one of Colorado's most flood-vulnerable communities. According to weather records, Boulder has had major flood events in 1894, 1896, 1906, 1909, 1916, 1921, 1938, and 1969, although most of these occurred in the spring (NOAA, 2013b). Boulder County is within an alluvial fan and nearby Rocky Mountain National Park is a well-known alluvial fan and popular hiking location. Historical flooding events of note within the Missouri area have occurred in association with heavy rainfall and snowmelt events (1951, 1952, 1972, 1976, 1977, 1982, 1984, 1985, 1993, 1995, 2008, and 2011) (FEMA, 2013d) (Illinois Department of Natural Resources, 2013) (National Weather Service, 2010).

3.6.4.10.2 Surface Water

The Missouri watershed is one of the largest hydrologic regions in the country. The topography consists of plains mixed with tablelands and hills (EPA, 2013g). Agricultural activities and resource extraction have replaced grasslands; causing many areas to be subject to droughts. There are 35 major river systems within the area: Saskatchewan, Gallatin, Jefferson, Madison, Marias, Musselshell, Milk, Poplar, Yellowstone, Bighorn, Powder, Tongue, Little Missouri, Cheyenne, White, Niobrara, Ponca Creek, James, Big Sioux, North Platte, South Platte, Platte, Loup, Elkhorn, Little Sioux, Nishnabotna, Kansas, Republican, Smoky Hill, Chariton, Grand, Little Chariton, Gasconade, Osage, and Missouri (USGS, 2013f). Many parts of the Missouri River have been dammed, creating large reservoirs including Lake Sakakawea and Oahe Reservoir (EPA, 2009).

3.6.4.10.2.1 Surface Water Quality

Approximately one-half of the 100,000 miles of rivers and streams in the Missouri watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fisheries, irrigation, public water supply, and recreation. The top three causes of impairment are pathogens, nutrients, habitat alterations. The top three probable sources for impairment are agriculture, nonpoint source pollution, and hydromodification. (EPA, 2013d)

Approximately three-quarters of the estimated 2,344 square miles of lakes, reservoirs, and ponds assessed in the Missouri watershed are impaired. Designated uses of the impaired surface waters include aesthetics, agriculture, aquatic life, fisheries, fish consumption, irrigation, public water supply, and recreation. The top three causes of impairment are mercury, nutrients, and metals. The top three probable sources for impairment are atmospheric deposition, nonpoint source pollution, and resource extraction. (EPA, 2013d)

3.6.4.10.3 Wild and Scenic Rivers

Within the Missouri watershed, there are 5 Wild and Scenic Rivers designations in 5 states (1 each in Nebraska, Colorado, Montana, Wyoming, and one that flows through Nebraska and South Dakota), totaling 448 miles. There are 115 miles of river classified as wild, 102 miles classified as scenic, and 231 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.10.4 Groundwater

The Missouri watershed contains sand and gravel aquifers, sandstone aquifers, sandstone and carbonate-rock aquifers, carbonate-rock aquifers, and unconsolidated and semi-consolidated sand and gravel aquifers (see Figure 3-15). There is currently one designated SSA in the Missouri watershed (EPA, 2013h) (EPA, 2013i). The USGS study, *Groundwater Depletion in the United States (1900–2008),* identified moderate to severe aquifer level depletion within the watershed (Konikow, 2013). The aquifers in South Dakota, the northwest corner of Kansas, the northeast corner of Colorado, the southwest corner of Nebraska, and the southeast corner of Wyoming are areas of notable groundwater level decline (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.10.4.1 Groundwater Quality

The watershed has good overall water quality, although there are elevated levels of sulfate and metals in local groundwater near mining areas. Elevated concentrations of nutrients and pesticides are also present in shallow groundwater near agricultural areas (National Weather Service, 2010) (Stark, et al., 2000).

3.6.4.11 Arkansas-White-Red (11)

The HUC-2 Arkansas-White-Red (11) watershed includes the Arkansas, White, and Red River Basins above the points of highest backwater effect of the Mississippi River. The Arkansas-White-Red watershed includes all of Oklahoma and parts of Arkansas, Colorado, Kansas, Louisiana, Missouri, New Mexico, and Texas (USGS, 2013f). Parts of FEMA Regions VI, VII, and VIII are within this watershed.

3.6.4.11.1 Floodplains

Floodplains within the Arkansas-White-Red watershed predominantly receive floodwaters during spring and summer (USGS, 2001a). Floodplains within this drainage area share characteristics of the Missouri and Mississippi River drainage basin. Floodplains in the area have been altered by the creation of reservoirs and other flood control mechanisms as well as development along rivers and streambanks (Oklahoma Water Resources Board, 1995).

Flooding events of note within the Arkansas-White-Red watershed have occurred in association with Hurricane Isaac (2012), Hurricanes Gustav and Ike (2008), Tropical Storm Allison (1989), Hurricane Alicia (1983), and heavy rainfall events (1990, 1991, 2008, and 2011) (FEMA, 2013d).

3.6.4.11.2 Surface Water

Agriculture has altered surface water availability and quality in the watershed. There are 14 major river systems: White, Little Red, Arkansas, Walnut, Cimarron, Neosho, Verdigris, Canadian, North Fork Red, Prairie Dog Town Fork Red, Salt Fork Red, Washita, Sulphur, and Red (USGS, 2013f). The Arkansas-White-Red watershed suffers from drought and reservoirs have been created along the rivers for water supply (Oklahoma Water Resources Board, 1995).

3.6.4.11.2.1 Surface Water Quality

More than half of the 50,000 miles of rivers and streams in the Arkansas-White-Red watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include aesthetics, agriculture, aquatic life, fisheries, fish consumption, irrigation, public water supply, recreation, and wildlife. The top three causes of impairment are pathogens, TDS, sulfates, and sediments. The top three probable sources for impairment are nonpoint source pollution, agriculture, and municipal discharges/sewage. (EPA, 2013d)

Almost all of the estimated 1,563 square miles of lakes, reservoirs, and ponds assessed within the Arkansas-White-Red watershed are impaired. Designated uses of the impaired surface waters include aesthetics, agriculture, aquatic life, fisheries, fish consumption, public and private water supply, and recreation. The top three causes of impairment are mercury, low dissolved oxygen, and turbidity. The top three probable sources for impairment are nonpoint source pollution, atmospheric deposition, and resource extraction. (EPA, 2013d)

3.6.4.11.3 Wild and Scenic Rivers

Within the Arkansas-White-Red watershed, there are 9 Wild and Scenic Rivers designations in 3 states (1 each in Louisiana and Missouri, and 7 in Arkansas) totaling 258 miles. There are 17 miles of river classified as wild, 200 miles classified as scenic, and 41 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.11.4 Groundwater

The Arkansas-White-Red watershed contains sand and gravel aquifers, sandstone aquifers; and carbonate-rock aquifers, as shown in Figure 3-15. There are no designated SSAs (EPA, 2013h) (EPA, 2013i) (EPA, 2012d). The aquifers in Texas, Oklahoma, and southwest Kansas are areas of notable groundwater level decline (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.11.4.1 Groundwater Quality

Groundwater quality is generally good throughout the Arkansas-White-Red watershed (Qi & Christenson, 2010).

3.6.4.12 Texas-Gulf (12)

The HUC-2 Texas-Gulf (12) watershed includes the drainage area from the Sabine Pass to the Rio Grande Basin, and covers parts of Louisiana, New Mexico, and Texas (USGS, 2013f). The Texas-Gulf watershed extends from the Gulf of Mexico northwest for approximately 650 miles into the southern Great Plains. Almost the entire region (94 percent) lies within the State of Texas, although small portions of Louisiana (1 percent) and New Mexico (5 percent) are included (Texas Coastal Management Program, 2011). FEMA Region VI is within this watershed.

3.6.4.12.1 Floodplains

The area receives floodwaters during spring, summer, and fall (USGS, 2001a). Floodplains in the eastern part of the Texas-Gulf watershed are broad and flat forested areas with slow moving rivers and poor drainage and floods are generally slow and sustained. In the central and western parts of the Texas-Gulf area, precipitation and surface water are less common. The geologic environment and livestock grazing increase the risk of flash flooding. Coastal areas are subject to flooding from heavy rain and tidal surge. Inland areas often receive large amounts of rainfall as marine storms weaken over the watershed. (U.S. Water Resources Council, 1978)

Flooding events of note within the Texas-Gulf watershed have occurred in association with Hurricanes Gustav and Ike (2008), Hurricane Rita (2005), Tropical Storm Allison (2001), Hurricane Chantal (1989), Tropical Storm Allison (1989), Hurricane Alicia (1983), Hurricane Allen (1980), Tropical Storm

Claudette (1979), and heavy rainfall events (1979, 1981, 1989, 1992, 1994, 1998, 2002, 2009) (FEMA, 2013d).

3.6.4.12.2 Surface Water

Freshwater
The eastern part of the watershed is relatively flat where rivers flow towards the Gulf of Mexico through forested lands (EPA, 2013g). The western area of the watershed is arid with dry plains and shrubland, and over extraction of water resources for agriculture. There are 12 river systems: Sabine, Neches, Trinity, Double Mountain Fork Brazos, Salt Fork Brazos, Brazos, Castleman Creek, Colorado, Oak Creek, Guadalupe, San Antonio, and Nueces (USGS, 2013f). Major reservoirs include Sam Rayburn and Toledo Bend (EPA, 2009).

3.6.4.12.2.1 Estuarine and Coastal

Estuarine ecosystems cover more than 4,000 square miles along the Gulf Coast of Texas. Estuarine and coastal environments in this region are highly diverse, consisting of unrestricted open bays, semi-enclosed lagoons, tidal marshes, and delta complexes. Texas has seven major and five minor estuaries ranging from the nearly fresh Sabine Lake, which borders Louisiana, to the frequently hypersaline (contains salt concentrations greater than ocean water, 3.5 percent) Laguna Madre along the southern coast. (USFWS, 2006)

3.6.4.12.2.2 Surface Water Quality

3.6.4.12.2.2.1 <u>Freshwater</u>
Approximately one-half of the 15,000 miles of rivers and streams in the Texas-Gulf watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fisheries, fish consumption, irrigation, recreation, and wildlife. The top three causes of impairment are pathogens, low dissolved oxygen, and mercury. The top three probable sources for impairment are nonpoint source pollution, agriculture, and municipal discharges/sewage. (EPA, 2013d)

Less than half of the estimated 1,250 square miles of lakes, reservoirs, and ponds assessed in the Texas-Gulf watershed are impaired. Designated uses of the impaired surface waters include aquatic life, fisheries, fish consumption, public water supply, and recreation. The top three causes of impairment are mercury, turbidity, and sulfates. The top three probable sources for impairment are nonpoint source pollution, atmospheric deposition, and municipal discharges/sewage. (EPA, 2013d)

3.6.4.12.2.2.2 <u>Estuarine and Coastal</u>
Most estuaries in the Texas-Gulf watershed have shallow depths and small tidal ranges, leading to low dilution and flushing rates. Consequently, most estuaries have either a moderate or a high susceptibility to nutrient loading. The combined effects of high nitrogen loads and a moderate or high susceptibility to nutrients results in most systems having poor water quality. The upper coast of Texas has experienced extensive loss of coastal habitats, primarily due to subsidence, erosion, sea level rise, agriculture, and residential and commercial development. For example, since the 1950s the Galveston Bay watershed has lost more than 50 percent of its tallgrass prairie and nearly 70 percent of its seagrass meadows. Estuaries within the Coastal Bend Region have been most impacted by land activities (urban runoff, sedimentation,

and agriculture) and have the highest levels of contamination. (Texas Coastal Management Program, 2011)

3.6.4.12.3 Wild and Scenic Rivers

There are no Wild and Scenic Rivers designations within this watershed (National Wild and Scenic Rivers System, 2016).

3.6.4.12.4 Groundwater

As shown in Figure 3-15, the Texas-Gulf watershed contains alluvial sand and gravel aquifers, and sandstone and carbonate-rock aquifers. There are three designated SSAs in the Texas-Gulf watershed (EPA, 2012d). The aquifers in northwest Texas and Oklahoma and southwest Kansas are areas of notable groundwater level decline, ranging from 50 to more than 1,000 feet (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.12.4.1 Groundwater Quality

Most of the groundwater within the watershed meets State and Federal drinking water standards. However, in some parts of the Texas-Gulf watershed naturally occurring levels of TDS, arsenic, and radionuclides, as well as human-caused contamination (e.g., pesticides and VOCs) have been detected in shallow aquifer systems. (Maupin & Barber, Regional Assessment of Groundwater Quality in the Mississippi Embayment-Texas Coastal Uplands Aquifer System, Coastal Lowlands Aquifer System, and the Edwards-Trinity Aquifer System, 2005) (Qi & Christenson, 2010)

3.6.4.13 Rio Grande (13)

The HUC-2 Rio Grande (13) watershed includes the Rio Grande Basin and the San Luis Valley, North Plains, Plains of San Agustin, Mimbres River, Estancia, Jornada Del Muerto, Tularosa Valley, Salt Basin, and other closed basins. The Rio Grande area includes parts of Colorado, New Mexico, and Texas (USGS, 2013f). Parts of FEMA Regions VI and VIII are within this watershed.

3.6.4.13.1 Floodplains

Floodplains within the Rio Grande watershed predominantly receive floodwaters during early spring and summer (USGS, 2001a). High precipitation causes floods and eventually droughts result in low surface water. Levees, agriculture, and irrigation have altered the natural hydrology of the area (Middle Rio Grande Conservancy District, 2016).

The Middle Rio Grande Basin encompasses the floodplain of the Rio Grande and the surrounding terrain that slopes from surface-drainage divides toward the river. The eastern boundary of the basin is largely mountainous, with merging alluvial fans and stream terraces leading downslope to the Rio Grande (Bartolino & Cole, 2002). Floodplains in other sections of the drainage area are commonly wide sandbars adjacent to river channels, which are bordered by thin-forested areas of willow or cottonwood (Save Our Bosque Task Force, 2004).

Flooding events of note within the Rio Grande watershed have occurred in association with Hurricane Alex (2010), Hurricane Allen (1980), and heavy rainfall events (1998, 2002, and 2009) (FEMA, 2013d) (National Weather Service, 2013).

3.6.4.13.2 Surface Water

Surface water within the Rio Grande watershed is dominated by the Rio Grande, which flows through arid plateaus as well as several mountain ranges (EPA, 2013g). Closer to the Gulf of Mexico, the Rio Grande area becomes flat. Surface water is an important commodity and can have vast changes from abundant to scarce. The three major river systems are the Pecos, Delaware, and Rio Grande (USGS, 2013f). The Rio Grande watershed has many closed basins that do not discharge to the Gulf of Mexico including: San Luis Valley, North Plains, Jornada Del Muerto, Plains of San Agustin, Jornada Draw, Mimbres River, Estancia, Tularosa Valley, and Salt Basin. Amistad and Falcon Reservoirs are major human-made lakes along the Rio Grande (EPA, 2009).

3.6.4.13.2.1 Surface Water Quality

Approximately one-third of the 15,000 miles of rivers and streams in the Rio Grande watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fish consumption, irrigation, public water supply, and recreation. The top three causes of impairment are pathogens, metals, and low dissolved oxygen. The top three probable sources for impairment are nonpoint source pollution, agriculture, and municipal discharge/sewage. (EPA, 2013d)

Less than one-half of the estimated 781 square miles of lakes, reservoirs, and ponds assessed in the Rio Grande watershed are impaired. Designated uses of the impaired surface waters include aquatic life, fish consumption, public water supply, and recreation. The top three causes of impairment are mercury, salinity, and pH. The top three probable sources for impairment are nonpoint source pollution, atmospheric deposition, and municipal discharge/sewage. (EPA, 2013d)

3.6.4.13.3 Wild and Scenic Rivers

Within the Rio Grande watershed, there are 5 Wild and Scenic Rivers designations in 2 states (1 in Texas and 4 in New Mexico) totaling 316 miles. There are 189 miles of river classified as wild, 117 miles classified as scenic, and 10 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.13.4 Groundwater

The Rio Grande watershed contains alluvial sand and gravel aquifers, sandstone and carbonate-rock aquifers, and carbonate-rock aquifers as shown in Figure 3-15. There are no designated SSAs in the Rio Grande watershed (EPA, 2013i) (EPA, 2012d). The USGS study, *Groundwater Depletion in the United States (1900–2008)*, identified minor aquifer level depletion within the watershed (Konikow, 2013).

The Salt Basin lies mostly in Texas, but a small part of the basin extends northward into New Mexico. The Salt Basin is a closed basin; that is, no surface drainage leaves the basin. Recharge to the basin fill is mainly by runoff from the bordering mountains into alluvial fans (Ryder, 1996).

3.6.4.13.4.1 Groundwater Quality

Elevated nitrate levels occur in groundwater in agricultural areas such as the San Luis and Rincon Valleys, and pesticides were detected in aquifers in agricultural and urban areas of the Rio Grande watershed (Kenny, et al., 2014) (USFWS, 1988).

3.6.4.14 Upper Colorado (14)

The HUC-2 Upper Colorado (14) watershed includes drainages from the Colorado River Basin above the Lee Ferry compact point, and the Great Divide closed basin. The Upper Colorado watershed includes parts of Arizona, Colorado, New Mexico, Utah, and Wyoming (USGS, 2013f). Parts of FEMA Regions VI, VIII, and IX are within this watershed.

3.6.4.14.1 Floodplains

Three main features of floodplains within this drainage basin are depressions, terraces, and constructed gravel pits (Valdez & Nelson, 2006). Depressions and gravel pits are opposite the natural levee from the river channel. Flooding events of note occurred in association with heavy rainfall and snowmelt events (in 1983 and 1984) (Bureau of Reclamation, 1990).

3.6.4.14.2 Surface Water

Surface water within the Upper Colorado watershed is primarily rivers and streams (EPA, 2013g). The mountainous topography is mixed with high plateaus. Surface water begins from snowmelt in the mountains where it quickly becomes sparse in the drier southern parts of the area. Major river systems include Gunnison, Bitter Creek, Green, Yampa, White, San Juan, and Colorado (USGS, 2013f). The Great Divide closed basin in Wyoming is part of the Upper Colorado area. Various diversions within tributaries of the Upper Colorado River regulate and deplete the flow of the river. For example, Gunnison River is largely regulated by Morrow Point, Blue Mesa, Crystal, Taylor Park, and Ridgeway dams. Tributary inflows can periodically affect mainstream flows during spring snowmelt runoff or late-summer monsoonal rainstorms. (Valdez & Nelson, 2006) Lakes within the watershed are mostly human-made reservoirs for water supply. Lake Powell is a large reservoir of the Colorado River north of the Grand Canyon (EPA, 2009).

Surface Water Quality
Less than one-quarter of the 40,000 miles of rivers and streams in the Upper Colorado watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fisheries, fish consumption, public water supply, recreation, and wildlife habitat. The top three causes of impairment are metals, pathogens, and temperature. The top three probable sources for impairment are nonpoint source pollution, agriculture, and industrial sources. (EPA, 2013d)

Approximately one-third of the estimated 469 square miles of lakes, reservoirs, and ponds assessed in the Upper Colorado watershed are impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, domestic water source, fisheries, and recreation. The top three causes of impairment are nutrients, PCBs, and mercury. The top three probable sources for impairment are agriculture, nonpoint source pollution, and municipal discharges/sewage. (EPA, 2013d)

3.6.4.14.3 Wild and Scenic Rivers

Within the Upper Colorado watershed, there are no Wild and Scenic Rivers designations (National Wild and Scenic Rivers System, 2016).

3.6.4.14.4 Groundwater

The Upper Colorado watershed contains sandstone aquifers (as shown in Figure 3-15). There are two designated SSAs within the area (EPA, 2013i). Within the watershed, there are no notable areas of groundwater decline (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.14.4.1 Groundwater Quality

With the exception of radon, groundwater quality in the urban areas of the Southern Rocky Mountains generally meet Federal and State standards for drinking water. The presence of elevated nitrate concentrations, pesticides, and low concentrations of VOCs indicate some influence on the quality of groundwater from human activities. Bacteria have been reported in groundwater samples and can occur naturally or indicate human influences. (Spahr, et al., 2000)

3.6.4.15 Lower Colorado (15)

The HUC-2 Lower Colorado (15) watershed includes the drainage of the Colorado River Basin below the Lee Ferry compact point and streams that originate within the United States and discharge into the Gulf of California. The Animas Valley, Willcox Playa, and other smaller closed basins are also in the Lower Colorado watershed. The Lower Colorado area includes parts of Arizona, California, Nevada, New Mexico, and Utah (USGS, 2013f). Parts of FEMA Regions VI, VIII, and IX are within this watershed.

3.6.4.15.1 Floodplains

Floodplains within the Lower Colorado watershed predominantly receive floodwaters during early spring and again in late summer and fall (USGS, 2001a). The modification of the Colorado River, primarily by dams, has greatly altered the river's hydrology. The Lower Colorado River system is the main source of water in an otherwise arid landscape and its floodplains are lowland vegetated communities along the rivers and streams. Highly erodible soil resulted in canyons and broad alluvial fans occur throughout the area (USFWS, 1988).

Flooding events of note within the Lower Colorado watershed occurred in association with heavy rainfall and snowmelt events (1941, 1952, 1957, 1983, 1993, 1997, and 2005) (Arizona Geological Survey, Undated) (Utah Department of Public Safety, 2011) (Bureau of Reclamation, 1990).

3.6.4.15.2 Surface Water

Mountains, plateaus, and canyons dominate the Lower Colorado River basin landscape (EPA, 2013g). Major river systems include Little Colorado, Gila, Salt, and Colorado (USGS, 2013f). Lake Mead and Lake Havasu are reservoirs along the Colorado River (EPA, 2009).

Surface Water Quality
The increasing human population within the area has caused higher water removal from river systems and reservoirs. Almost all of the 5,000 miles of rivers and streams in the Lower Colorado watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fisheries, fish consumption, irrigation, industrial uses, public water supply, recreation, and wildlife. The top three causes of impairment are temperature, nutrients, and metals. The top three probable sources for impairment are nonpoint source pollution, agriculture, and habitat alterations. (EPA, 2013d)

Almost all of the estimated 78 square miles of lakes, reservoirs, and ponds assessed in the Lower Colorado watershed (excluding Arizona) are impaired. Designated uses of the impaired surface waters include aesthetics, agriculture, aquatic life, fisheries, fish consumption, irrigation, public water supply, recreation, and wildlife. The top three causes of impairment are nutrients, metals, and mercury. The top three probable sources for impairment are agriculture, nonpoint source pollution, and municipal discharges/sewage. (EPA, 2013d)

3.6.4.15.3 Wild and Scenic Rivers

Within the Lower Colorado watershed, there are three Wild and Scenic Rivers designations in two states (2 in Arizona and 1 in Utah) totaling 227 miles. There are 177 miles of river classified as wild, 30 miles classified as scenic, and 20 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.15.4 Groundwater

The Lower Colorado watershed contains three types of principal aquifers: basin-fill aquifers, sandstone aquifers, and carbonate-rock aquifers, as shown in Figure 3-15. There are two designated SSAs (EPA, 2012e). In most of the area, there are no notable areas of groundwater decline (Reilly, Dennehy, Alley, & Cunningham, 2008). However, irrigation and mine dewatering lowered the overall groundwater water levels in shallow aquifers in Arizona.

3.6.4.15.4.1 Groundwater Quality

The aquifer bedrock influences groundwater quality within the area. Elevated TDS and salinity are present in alluvium or in areas with sedimentary bedrock and elevated metals are present in the groundwater in mining areas. There is generally good water quality in the deep, carbonate-rock aquifers. (Qi & Christenson, 2010) (Spahr, et al., 2000)

3.6.4.16 Great Basin (16)

The HUC-2 Great Basin (16) watershed includes the drainage of the Great Basin in Utah and Nevada, and parts of California, Idaho, Nevada, Oregon, Utah, and Wyoming (USGS, 2013f). Parts of FEMA Regions VIII and IX are within this watershed.

3.6.4.16.1 Floodplains

Floodplains within the Great Basin watershed predominantly receive floodwaters during late spring and summer (USGS, 2001a). The unconsolidated alluvial fans represent a principle groundwater resource and land development hazard within the Great Basin watershed. Narrow floodplains occur within the mountainous areas and broad, flat floodplains dominate the high plateaus (NPS, 1991). Water diversion in this arid area has reduced the amount of surface water and associated riparian floodplain communities (Sada, 2008).

Flooding events of note within the area occurred in association with heavy rainfall and snowmelt events (1952, 1963, 1983, 1984, 1986, 1997, 2005, 2006, and 2010) (FEMA, 2013d) (Utah Department of Public Safety, 2011).

3.6.4.16.2 Surface Water

The Great Basin watershed is a closed basin; it retains water and allows no outflow to external bodies of water such as rivers or oceans. Within the basin, rivers and streams begin from snowmelt in the mountains and travel down to the arid high plateau (EPA, 2013g). There are seven major river systems: Bear, Weber, Jordan, Humboldt, Carson, Truckee, and Walker (USGS, 2013f). Main lakes and desert basins within this watershed include Great Salt Lake, Escalante Desert-Sevier Lake, Black Rock Desert, and Central Nevada Desert (EPA, 2009).

3.6.4.16.2.1 Surface Water Quality

Approximately 1,500 of the 10,000 miles of rivers and streams in the area, that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include agriculture, aquatic life, fish consumption, irrigation, public water supply, recreation, and wildlife. The top three causes of impairment are temperature, nutrients, and low dissolved oxygen. The top three probable sources for impairment are nonpoint source pollution, agriculture, and industrial. (EPA, 2013d)

Approximately one-half of the more than 625 square miles of lakes, reservoirs, and ponds assessed in the Great Basin watershed are impaired. Designated uses of lakes, reservoirs, and ponds that have been impaired within the area include aesthetics, agriculture, aquatic life, fish consumption, irrigation, public water supply, recreation, and wildlife. The top three causes of impairment are nutrients, PCBs, and TDS. The top three probable sources for impairment are agriculture, nonpoint source pollution, and municipal discharges/sewage. (EPA, 2013d)

3.6.4.16.3 Wild and Scenic Rivers

Within the Great Basin watershed, there are no Wild and Scenic Rivers designations (National Wild and Scenic Rivers System, 2016).

3.6.4.16.4 Groundwater

The Great Basin watershed contains three types of aquifers: basin-fill aquifers, volcanic-rock aquifers, and carbonate-rock aquifers (Figure 3-15). There are no designated SSAs within the watershed (EPA, 2013i) (EPA, 2012e). The USGS study, *Groundwater Depletion in the United States (1900–2008),* identified minor aquifer level depletion within the Great Basin watershed (Konikow, 2013).

3.6.4.16.4.1 Groundwater Quality

Groundwater quality within the Great Basin is influenced by the nature of the aquifer bedrock. There is generally good water quality in the deep, carbonate-rock aquifers. Elevated TDS and salinity are present in central parts of the basin-fill aquifers, elevated metals are in groundwater in historic mining areas, and elevated nitrate and pesticide concentrations in shallow groundwater in agricultural areas. (USGS, 2013g)

3.6.4.17 Pacific Northwest (17)

The HUC-2 Pacific Northwest (17) watershed drains to the Straits of Georgia and of Juan De Fuca, and the Pacific Ocean, from Oregon and Washington. The Pacific Northwest watershed includes all of Washington and parts of California, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming (USGS, 2013f). Parts of FEMA Regions VIII, IX, and X are within this watershed.

3.6.4.17.1 Floodplains

Floodplains in the Pacific Northwest predominantly receive floodwaters during winter and early spring (USGS, 2001a). Washington is one of the highest flood risks of the country. Specific characteristics of the Pacific Northwest floodplains include the braided channel complex of river and alluvial fans. (Washington State Department of Ecology, 2007)

Flooding events of note within the area occurred in association with heavy rainfall and snowmelt events, including, within the past 15 years (2003, 2005, 2006, 2007, 2010, and 2011) (NOAA, 2016a) (FEMA, 2013d).

3.6.4.17.2 Surface Water

3.6.4.17.2.1 Freshwater

Rivers, streams, and lakes are prevalent throughout the mountains, valleys, and plateaus of the Pacific Northwest area (EPA, 2013g). Rainfall and snowmelt are the primary sources for surface water. Streams generally begin in the mountains with steep channels and plunge pools. There are 16 major river systems: Kootenai, Pend Oreille, Spokane, Yakima, Snake, Clover Creek, Powder, Salmon, Clearwater, John Day, Deschutes, Columbia, Willamette, Umpqua, Smith, and Fraser (USGS, 2013f). The Columbia River Basin drains most of the Pacific Northwest watershed, including western Montana, northern Idaho, and the eastern two-thirds of Washington. The Columbia River Basin was elevated to one of our Nation's Great Water Bodies, joining six other watersheds. The basin covers a significant portion of the Pacific Northwest and encompasses 260,000 square miles. Many rivers within the area have been altered by the creation of dams. Part of the Great Basin discharges into closed basins within Oregon. Kettle lakes and mountain calderas are naturally occurring lakes within this area. Examples of mountain calderas include Crater Lake in Oregon and Yellowstone Lake in Wyoming. (EPA, 2009) Agriculture and timber operations have affected the hydrology of the Pacific Northwest area (Oberrecht, 2002).

3.6.4.17.2.2 Estuarine

Major estuaries in this watershed include Puget Sound estuary (Washington), the Lower Columbia River estuary (Oregon and Washington), and the Tillamook Bay estuary (Oregon). The National Estuary Program identifies the estuaries as Estuaries of National Significance (EPA, 2015d). Puget Sound, the 2nd largest estuary in the United States, includes an arm of the Pacific Ocean and extends inland to meet 19 different river basins (Washington State Department of Ecology, 2016). The Columbia River estuary is one of the largest estuaries on the West Coast with over 125 square miles in Oregon alone. Additionally, the Tillamook Bay estuary encompasses an area between rugged mountains and the Pacific Ocean within Oregon. (Good, 2015)

3.6.4.17.2.3 Surface Water Quality

3.6.4.17.2.3.1 Freshwater
Approximately half of the 100,000 miles of rivers and streams in the Pacific Northwest watershed that have been assessed for water quality are designated as impaired. Designated uses of the impaired surface waters include aesthetics, agriculture, aquatic life, fisheries, public water supply, and recreation. The top three causes of impairment are temperature, sediments, and nutrients. The top three probable sources for impairment are agriculture, nonpoint source pollution, and habitat alterations. (EPA, 2013d)

Approximately three-quarters of the estimated 156 square miles of lakes, reservoirs, and ponds assessed in the Pacific Northwest watershed are impaired. Designated uses of the impaired surface waters include aesthetics, aquatic life, fisheries, public water supply, and recreation. The top three causes of impairment are nutrients, mercury, and habitat alterations. The top three probable sources for impairment are resource extraction, atmospheric deposition, and municipal discharges/sewage. (EPA, 2013d)

3.6.4.17.2.4 Estuarine

Surface water quality within the Oregon and Washington coastal zone is generally good; however, in some areas water quality is degraded due to human activity and natural conditions. Because of degraded water quality, numerous rivers and streams in the coastal zone are included on the Washington Department of Ecology's 303(d) list of water quality impaired or threatened water bodies. About 75 percent of Puget Sound's estuaries and their adjacent habitats, such as grasslands, mixed woodlands and floodplain forests, have been modified so significantly that they no longer provide original functions. (EPA, 2012c)

Dissolved oxygen and levels of nitrogen are considered good for Pacific Northwest estuaries, except in some isolated regions of Puget Sound. The primary problem in Northwestern estuaries is degraded sediment quality, with 21 percent of estuarine sediments exceeding contaminant guidelines. For most of the Pacific Northwest, sediment contamination was due to exceedance for multiple compounds rather than for a single compound. (EPA, 2012c)

3.6.4.17.3 Wild and Scenic Rivers

Within the Pacific Northwest watershed, there are 69 Wild and Scenic Rivers designations in 4 states (2 each in Montana and Wyoming, 6 in Washington, and 59 in Oregon) totaling approximately 2,958 miles. There are approximately 1,100 miles of river classified as wild, 710 miles classified as scenic, and 1,148 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.17.4 Groundwater

The Pacific Northwest watershed contains a mixture of basin-fill, sand and gravel, and basaltic-rock aquifers, as shown in Figure 3-15. There are 14 designated SSAs within the watershed (EPA, 2013j). There are areas of notable groundwater level decline in southeastern Washington, northern Oregon, and southern Idaho (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.17.4.1 Groundwater Quality

The basaltic-rock aquifers are highly susceptible to contamination because they are mostly unconfined and are overlain by thin or well-drained soils (USGS, 2013h).

3.6.4.18 California (18)

The HUC-2 California (18) watershed includes all California watersheds that drain toward the Pacific Ocean. Nevada and Oregon are also in this HUC (USGS, 2013f). Parts of FEMA Regions IX and X are within this watershed.

3.6.4.18.1 Floodplains

Floodplains within the California watershed predominantly receive floodwaters during winter and early spring. However, the extreme southeast portion of the area floods during late summer and fall (USGS, 2001a). Floodplain ecosystems within this watershed are an assortment of willow and cottonwood riparian forests, grasslands, and marshes. Floodplains vary with the area depending on water availability, topography, and development (Crain, Whitener, & and Moyle, 2004). Alluvial fans are common throughout Southern California; several are within Death Valley.

Flooding is a problem for low-lying coastal areas, especially during El Niño storm conditions. With an increase in sea level rise, flood risks will expand to new areas along the coast and coastal waterways that reach further inland. A study by the Pacific Institute found that 260,000 people in California are currently living in areas that, without some type of protection, would be vulnerable to inundation from a 100-year flood event. Historic flooding events of note within the California watershed have occurred in association with Tropical Storm Marge (1982) and heavy rainfall, snowmelt, and tsunami events. (1964, 1972, 1986, 1995, 1996, 1998, 2005, and 2011) (California Natural Resources Agency, 2013) (FEMA, 2013d)

3.6.4.18.2 Surface Water

3.6.4.18.2.1 Freshwater

The California watershed has a mix of mountains, valleys, and deserts making for a variety of surface water types (EPA, 2013g). The eastern and southern parts are arid deserts highlighted by salt lakes. Forested mountain ranges offer high lakes and streams, some of which flow to the Central Valley's numerous rivers. Agriculture, timber operations, and major development contribute pollutants and runoff to the aquatic ecosystems. Major river systems within the area include Klamath, Smith, Stemple Creek, Sacramento, San Joaquin, Pescadero Creek, Rincon Creek, and San Gabriel (USGS, 2013f). Several closed basins occur within the area including: Tulare Lake, Buena Vista Lake, North Lahontan, Mono Lake, Owens Lake, Death Valley, Upper and Lower Mojave Desert, and Salton Sea (EPA, 2009).

3.6.4.18.2.2 Estuarine and Coastal

The San Francisco Bay and the Sacramento-San Joaquin delta form the West Coast's largest estuary, and drain about 40 percent of California's land. California also has numerous small, deep, and moderately well-flushed estuaries with moderately sized watersheds. This biologically diverse area encompasses coastal wetlands and estuaries, coastal plains, mesas and foothills, multiple watersheds, coastal and inland mountain ranges, valleys, desert and dunes. In Southern California, exposed sandy beaches make up over 75 percent of the shoreline and approximately 23 percent of the Channel Islands coastlines. (California Coastal Commission, 2011)

3.6.4.18.2.3 Surface Water Quality

3.6.4.18.2.3.1 <u>Freshwater</u>
Just over half of the 50,000 miles of rivers and streams in the California watershed that have been assessed for water quality are designated as impaired. Designated uses of impaired surface waters include agriculture, fisheries, habitats, industrial uses, public water supply, recreation, and wildlife. The top three causes of impairment are temperature, sediment, and nutrients. The top three probable sources for impairment are habitat alterations, nonpoint source pollution, and silviculture. (EPA, 2013d)

Almost all of the estimated 8 square miles of lakes, reservoirs, and ponds assessed in the California watershed are impaired. Designated uses of the impaired surface waters include agriculture, fisheries, habitats, public water supply, recreation, and wildlife. The top three causes of impairment are metals, mercury, and nutrients. The top three probable sources for impairment are nonpoint source pollution, agriculture, and industrial sources. (EPA, 2013d)

3.6.4.18.2.3.2 <u>Estuarine and Coastal</u>
California has several estuaries with poor water quality, including San Francisco Bay and its sub-estuaries, and other estuaries along the California coast. High nitrogen levels persist along the central California coast while high phosphorus has been measured in most California coastal waters, particularly in the San Francisco Estuary. High sediment contamination from chemicals was found along the California coast and sediments found in several northern California small river estuaries exceeded toxicity levels for chromium. All the concentrations that exceeded the toxicity levels north of San Luis Obispo Bay, including the small northern California Rivers and the San Francisco Estuary, were due to chromium, mercury, or copper. In Southern California, the exceedances were due to dichloro-diphenyl-

trichloroethane (DDT), with the exception of the Los Angeles Harbor, which had high concentrations of several metals and polycyclic aromatic hydrocarbons. (EPA, 2012c)

3.6.4.18.3 Wild and Scenic Rivers

Within the California watershed, there are 26 Wild and Scenic Rivers designations in 2 states (4 in Oregon and 22 in California) totaling approximately 2,071 miles. There are approximately 808 miles of river classified as wild, 227 miles classified as scenic, and 1,036 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.18.4 Groundwater

The California watershed contains mostly unconsolidated and semi-consolidated sand and gravel aquifers, basin-fill aquifers, and a series of alluvial aquifers with intermingled aquitards (i.e., zones within the earth that restrict the flow of groundwater from one aquifer to another) as shown in Figure 3-15. There are 4 designated SSAs within the watershed (EPA, 2012e). There are areas of notable groundwater level decline in central California (Reilly, Dennehy, Alley, & Cunningham, 2008). The most productive and highly used aquifers in the area are the northern California basin-fill aquifers. The Central Valley aquifer has a continued loss of stored groundwater in the southern part of the valley. (California Department of Water Resources, 2013)

3.6.4.18.4.1 Groundwater Quality

Agricultural practices in central California, combined with a high evaporation rate, have resulted in elevated nitrates and pesticides in shallow groundwater systems and substantial declines in shallow groundwater tables. Arsenic is the most widespread contaminant affecting an estimated 587 community drinking water wells. Seawater intrusion is a common problem in nearly all the coastal aquifers. (California Department of Water Resources, 2013)

3.6.4.19 Alaska (19)

The HUC-2 Alaska (19) watershed includes all of Alaska (USGS, 2013f). Only FEMA Region X is within the watershed. As the nation's only arctic State, Alaska's exclusive economic zone contains more than half of the nation's offshore waters, two-thirds of the nation's coastline (44,500 miles), 40 percent of the nation's surface water, 20 percent of the nation's land base, and 50 percent of the nation's wetlands.

3.6.4.19.1 Floodplains

Across most of Alaska, floodplains are extensive complexes of vegetation and sediment. Trees are able to grow on the alluvial terraces where shrubs dominate in most floodplains. In areas that are colder or more exposed, tundra vegetation is prevalent. (Karle & Densmore, 1994)

Seasonal flooding of floodplains in Alaska is a result of snowmelt, precipitation, glacial outbursts, ice jams, and seismic activity. Alaska experiences a wide variety of flooding risks including heavy runoff, flash floods, and snowmelt. Ice jam flooding, from the breakup or formation of winter ice cover on rivers results in damming, damage, rapid inundation, and glacial outburst floods are region-specific floods.

Glacier dammed lakes and the resulting outburst floods are a hazard along in the southcentral and southeast regions of the State, and in adjacent Canada where rivers drain into Alaska. Many of the glaciers in these areas flow across the mouths of adjoining valleys and cause lakes to form behind the ice streams. These glacier ice dams are subject to repeated failure and are serious hazard risks. (Mayo & Post, 1971)

In Alaska, floods account for over 50 percent of the State disaster emergencies and the preponderance of disaster relief spending for Alaska. During 2000-2009, seven flood specific events in Alaska were declared State or Federal disasters. Flooding events of note within Alaska have occurred in association with heavy rainfall, snowmelt, ice jams, and tsunamis (1946, 1957, 1958, 1964, 1973, 1974, 1989, 1991, 1994, 1995, 2002, 2004, 2005, 2006, 2008, 2009, 2011, and 2013). (FEMA, 2013e) (University of Southern California, Undated)

3.6.4.19.2 Surface Water

3.6.4.19.2.1 Freshwater

Alaska has the largest amount of surface water within the United States, although much of the surface water is frozen for half the year (Alaska Department of Natural Resources, 2013). Precipitation in excess of one Mgal/d feeds river, streams, lakes, and wetlands. Glaciers cover five percent of Alaska. Rivers and streams are heavily influenced by glaciers, which also contribute surface water to rivers and streams. Rivers travel through major valleys within the numerous mountain ranges. Urban development and natural resource extraction affect hydrology within Alaska. Major river systems include Colville, Kobuk, Yukon, Koyukuk, Kuskokwim, Nushagak, Susitna, and Copper (USGS, 2013f). The Yukon and Kuskokwim Rivers are the two largest rivers in Alaska (USFWS, 2002).

Estuarine and Coastal
The surface area of coastal bays and estuaries in Alaska is almost three times the total estuarine area of the contiguous 48 states (Dasher & Lomax, 2011). Much of the southeast and south-central Alaskan coast includes hundreds of bays, estuaries, coves, fjords, and other waterbodies (Dasher & Lomax, 2011). Most of the coastline is inaccessible by road, making a statewide coastal monitoring program logistically challenging and expensive (Dasher & Lomax, 2011). The marine environment of Alaska is divided into three major geographical subregions: Gulf of Alaska, the Bering Sea, and the Chukchi and Beaufort Seas in the Arctic Ocean (Stone & Shotwell, 2007).

3.6.4.19.2.2 Surface Water Quality

3.6.4.19.2.2.1 <u>Freshwater</u>
In Alaska, 443 miles of the 602 miles of rivers and streams that have been assessed for water quality are impaired. Designated uses of the impaired surface waters include aquatic life, agriculture, fisheries, industrial, public water supply, and recreation. The top three causes of impairment are turbidity, pathogens, and sediment. The top three probable sources for impairment are resource extraction, urban-related runoff, and construction. (EPA, 2013d)

Approximately one-half of Alaska's estimated 9 square miles of lakes, reservoirs, and ponds assessed are impaired. Designated uses of the impaired surface waters include aquatic life, agriculture, fisheries, public water supply, and recreation. The top three causes of impairment are petroleum hydrocarbons, low dissolved oxygen, and pathogens. The top three probable sources for impairment are recreational pollution, urban-related runoff, and industrial sources. (EPA, 2013d)

3.6.4.19.2.2.2 Estuarine and Coastal

The large size and geographic complexity of Alaska's shoreline make comprehensive assessments of its coastal resources difficult. Alaska's coastal resources are not subject to population and development pressures to the same extent as the rest of the United States coastline. This is because of the State's low population density, the distance between most of its coastline and major urban or industrial areas, the lack of road access to most coastal areas, and limited agriculture activities. Consequently, some contaminant concentrations have been measured as having levels considerably lower than those in the rest of the coastal United States, although localized sources of trace metal and organic contaminants such as PCBs and mercury exist in Alaska. (EPA, 2012c)

The general water quality of Alaska's offshore waters is pristine. However, major river inputs (sediments) flow beyond coastal waters and into offshore waters. Waste discharge from petroleum-producing platforms, commercial fishing vessels, oil tankers, and cruise ships also contaminate coastal and marine waters. (EPA, 2012c)

3.6.4.19.3 Wild and Scenic Rivers

In Alaska, there are 25 Wild and Scenic Rivers, totaling 3,210 miles. There are 2,955 miles of river classified as wild, 227 miles classified as scenic, and 28 miles classified as recreational. (National Wild and Scenic Rivers System, 2016)

3.6.4.19.4 Groundwater

Alaska's aquifers consist of unconsolidated materials derived from glaciers, rivers, and streams, as shown in Figure 3-15. Producing aquifers are typically unconfined, and the depth to groundwater ranges from a few feet to over 400 feet statewide (Alaska Department of Environmental Conservation, 2012). Only a few of Alaska's aquifers have been identified (or studied), and water quality data for the area is limited (Alaska Department of Environmental Conservation, 2012). There are no SSAs nor areas of notable groundwater level decline in the watershed (EPA, 2013j) (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.19.4.1 Groundwater Quality

Although water quality data are sparse, most groundwater in Alaska is suitable for domestic, agriculture, aquaculture, commercial, and industrial uses with moderate or minimal treatment. Naturally occurring iron, manganese, and arsenic are the most common treatment problems in groundwater systems. Storage and spills of fuel, along with wastewater disposal, primarily from on-site wastewater disposal (septic) systems, are common threats to groundwater quality statewide. Additionally, other activities have affected, or potentially affected, groundwater quality (e.g., nonpoint source pollution in urban areas, natural resource extraction in remote locations, and a wide range of potential point sources of pollution). (Alaska Department of Environmental Conservation, 2012)

3.6.4.20 Hawaii (20)

The HUC-2 Hawaii (20) watershed covers the entire State of Hawaii (USGS, 2013f). FEMA Region IX is within this watershed.

3.6.4.20.1 Floodplains

Within Hawaii, topography defines floodplains. In the mountainous interior, floodplains are small areas along streams. Toward the coast, most areas flatten out and floodplains expand. Flooding is a statewide concern. (County of Hawaii, 2005)

Coastal flooding can result from two sources: storm surges from hurricanes or cyclones, and wave run-up from tsunamis. Flood risk in Hawaii includes flash floods, dam failure, storm surge, tsunami, riverine floods, coastal floods, and urban floods. In the Central North Pacific, which includes Hawaii, the official hurricane season runs from June through November. (Hawaii Coastal Management Program, 2010)

Flooding events of note within Hawaii have occurred in association with Hurricane Iniki (1992), Hurricane Iwa (1982), Hurricane Dot (1959), and heavy rainfall and tsunami events almost every year (since 2000: 2005, 2006, 2008, 2009, 2011, and 2012) (FEMA, 2013e).

3.6.4.20.2 Surface Water

3.6.4.20.2.1 Freshwater

Surface water within Hawaii is predominantly in the form of streams that originate in the mountain interiors and flow to the ocean. The surface water helped sculpt the landscape of the islands by eroding soil and creating stream channels. Development, agriculture, and erosion have affected the hydrology of surface water within Hawaii. (USGS, 2003d)

3.6.4.20.2.2 Estuarine and Coastal

As an island archipelago, the coastal zone in Hawaii is inclusive of all land area. Most of Hawaii's estuaries are small, occupying less than 0.5 square miles. These coastal waters represent less than one percent of the coastal ocean area around the Hawaiian Islands. (EPA, 2012c)

3.6.4.20.2.3 Surface Water Quality

3.6.4.20.2.3.1 <u>Freshwater</u>
The top three causes of impairment are turbidity, nutrients, and trash. There were no probable sources for impairment listed in the EPA's 2006 assessment (EPA, 2013d).

3.6.4.20.2.3.2 <u>Estuarine and Coastal</u>
In EPA's 2006 assessment report, all of the estimated 36 square miles of bay and estuaries assessed are impaired. The top three causes of impairment are turbidity, chlorophyll-a, and nitrogen. There were no probable sources contributed to impairments listed by EPA for 2006. Main sources of contamination include pollution from ocean uses, oil spills, and recreational uses. Additionally, polluted runoff from land-based sources has been identified as one of six major threats to coral reefs, as well as having negative impacts on other marine habitats and ecosystem functions. (EPA, 2013d)

3.6.4.20.3 Wild and Scenic Rivers

There are no Wild and Scenic Rivers designations in Hawaii (National Wild and Scenic Rivers System, 2016).

3.6.4.20.4 Groundwater

Hawaii contains one type of principal aquifer: volcanic-rock aquifers, as shown in Figure 3-15. There are two designated SSAs within the watershed (EPA, 2012e). While there were no areas of notable decline, the aquifers of individual Hawaiian Islands are isolated by seawater and have limited capacity. Fresh groundwater resources in Hawaii are therefore vulnerable to impacts from human activity and climate change (Reilly, Dennehy, Alley, & Cunningham, 2008).

3.6.4.20.4.1 Groundwater Quality

Volcanic-rock aquifers are susceptible to contamination and many areas within Hawaii have been farmed intensively, were irrigated heavily for most of the 20th century, and have had agricultural fertilizers and pesticides applied. Numerous agricultural and industrial chemicals have been detected in groundwater, although most concentrations are below human-health guidelines. Concentrations of constituents related to human activities (the pesticide dieldrin, three soil fumigants [ethylene dibromide, 1,2-dibromo-3-chloropropane, and 1,2-dichloropropane], and the solvent trichloroethylene) were more commonly detected above human-health benchmarks in groundwater on Oahu than groundwater in the similar aquifers. (USGS, 2013h)

3.6.4.21 Caribbean (21)

The HUC-2 Caribbean (21) watershed includes the Commonwealth of Puerto Rico and USVI (USGS, 2013f). FEMA Region II is within this watershed.

3.6.4.21.1 Floodplains

Development and agriculture within the Islands' floodplains is a serious threat to their functionality (USFWS, Undated(a)). Coastal flooding is typically caused by hurricanes, although tsunami events have not occurred in the Caribbean. Flooding events of note within the Caribbean area have occurred in association (within the last 15 years) include Hurricane Irene (2011), Tropical Storm Maria (2011), Hurricane Earl (2010), Tropical Storms Otto and Tomas (2010), Hurricane Omar (2008), Hurricane Jeanne (2004), and heavy rainfall events (2001, 2003, 2005, 2008, 2010, and 2011) (FEMA, 2013e).

Flooding is a frequent occurrence in Puerto Rico, often affecting highly developed and populated areas with resulting damage to private property and public infrastructure. In Puerto Rico, floods can be extremely destructive because of the island's steep, mountainous topography and relative proximity to dense population centers. Most of the island's major river systems have their headwaters in the central mountain range where rainfall during tropical storms and hurricanes is typically prolonged and intense. Approximately, one-third of the population on the island lives in flood prone areas and the consequent potential for property damage and loss of life is very high. (Lopez-Trujillo, 2010)

Floods in the USVI derive from rain (which creates inland flooding); sea surge from hurricanes or wind driven waves; and tsunamis. Destructive tsunamis occurred in the USVI in 1867 and in 1918; the latter resulted in 116 deaths and economic losses estimated at $4M (in 1918 dollars). Short-duration, localized flooding is a concern on the islands, especially in the event of a tropical storm or hurricane. (U.S. Virgin Islands Department of Planning and Natural Resources, 2008)

3.6.4.21.2 Surface Water

3.6.4.21.2.1 Freshwater

Small streams begin in the interior highlands and make their way to the ocean. Due to its size, Puerto Rico has more surface water than any other island within the Caribbean. Precipitation is the predominant supplier of surface water within the drainage. Many rivers in Puerto Rico have been altered for flood control, water supply, and hydropower. (USGS, 1993)

The USVI contains three large islands—St. Thomas, St. Croix, and St. John—and approximately 50 small islets and cays. Volcanic in origin, the USVI have no major rivers, streams, or lakes, but feature steep ridges and abundant coral reefs. The USVI coastal zone includes the islands and the waters extending seaward to the outer limits of the United States territorial sea. The coastal zone incorporates open waters, tidal flats, bays, inlets, wetlands, lagoons, beaches, dunes, bluffs, and upland areas. (U.S. Virgin Islands Department of Planning and Natural Resources, 2008)(U.S. Virgin Islands, Division of Fish and Wildlife, 2013)

3.6.4.21.2.2 Estuarine and Coastal

Puerto Rico contains approximately 700 miles of coastline. The Commonwealth has several unique coastal ecosystems such as bioluminescent bays, coral reefs, and mangrove lagoons. Located on the northern coast of the island territory of Puerto Rico, the San Juan Bay Estuary (Estuario de la Bahía de San Juan) is semi-enclosed by the surrounding mainland, mangroves, and wetlands and is linked to the Atlantic Ocean via a series of interconnected bays, channels, and lagoons. This estuarine system includes San Juan Bay; the Martín Peña, San Antonio, and Suárez channels; and the Condado, Los Corozos, San José, Torrecilla, and Piñones lagoons. Multiple tributaries flow into the San Juan Bay Estuary, the largest being the Puerto Nuevo River. Salt water enters the estuary from the Atlantic Ocean through the Boca del Morro to San Juan Bay, through El Boquerón to Condado Lagoon, and through Boca de Cangrejos to Torrecilla Lagoon. (EPA, 2007b)

3.6.4.21.2.3 Surface Water Quality

In Puerto Rico, the surface water is generally poor. Approximately 80 percent of the rivers, streams, lakes, and ponds that have been assessed are designated as impaired. Designated uses of the impaired surface waters include aquatic life, public water supply, and recreation. The top three causes of impairment are pathogens (fecal coliform), arsenic, and low dissolved oxygen. The top three probable sources for impairment are municipal discharges/sewage, CAFOs, and urban-related runoff/storm sewers. (EPA, 2013d)

Within the USVI, water quality is generally good, but declining due to an increase in point source discharges from the USVI municipal sewage treatment plants. Clogged and collapsed lines frequently cause discharges into surface waters. Stormwater also overwhelms sewage treatment facilities and results in bypasses of raw or undertreated sewage into bays and lagoons. Other water quality problems result from unpermitted discharges, permit violations by private industrial dischargers, oil spills, and unpermitted filling activities in mangrove swamps. Nonpoint sources of concern include failing septic systems, erosion from development, urban runoff, waste disposal from vessels, and spills. (U.S. Virgin Islands Department of Planning and Natural Resources, 2008)

3.6.4.21.2.4 Estuarine and Coastal

The overall condition of the San Juan Bay Estuary is rated poor. Bacterial contamination caused by the discharge of sewage from non-point sources has negatively affected water quality. A variety of toxic chemicals has been detected in the estuary's sediments and may persist at relatively high concentrations for some time. The limited flushing capacity and low tidal range of this estuarine system make the San Juan Bay Estuary susceptible to the retention of toxic pollutants. The development of maritime and air transportation infrastructure, as well as residential and industrial areas, has caused significant modification and loss of important habitats in the western half of the estuary's basin, where the pressures of urban growth and development on the San Juan Bay Estuary are greatest. (EPA, 2007b)

USVI estuarine areas were not assessed because these islands do not have water bodies that are true estuaries.

The overall coastal condition of the Caribbean coastal waters is relatively good, but it has been declining because of point and nonpoint source pollution discharges. The Caribbean region experiences heavy vessel traffic. Cruise ships emit large amounts of point source pollution that has the potential to affect water quality. (EPA, 2012c)

3.6.4.21.3 Wild and Scenic Rivers

There are three Wild and Scenic Rivers designations in Puerto Rico, totaling approximately 9 miles. There are 2 miles of river classified as wild, 5 miles classified as scenic, and 2 miles classified as recreational. There are no Wild and Scenic Rivers designations in the USVI. (National Wild and Scenic Rivers System, 2016)

3.6.4.21.4 Groundwater

All of the islands in the Caribbean watershed are composed mainly of a mixture of volcanic and sedimentary rocks, as shown in Figure 3-15. There are no SSAs in the Caribbean watershed (EPA, 2008a). Aquifer overdraft has caused the thinning saline-water encroachment and degraded groundwater quality in Puerto Rico. In 2011, the USGS, in cooperation with the Puerto Rico Department of Natural and Environmental Resources, began the Groundwater Quality Monitoring Project to obtain and analyze groundwater quality data at selected areas of Puerto Rico. The project showed TDS concentrations above the secondary maximum contaminant level in groundwater samples collected from wells in the upper aquifer of the North Coast Limestone Aquifer System and South Coast aquifers in Puerto Rico. In addition, nitrate concentrations in groundwater above the maximum contaminant level for drinking water were detected in both State aquifers. (Rodriguez, 2014)

3.6.4.21.4.1 Groundwater Quality

Groundwater resources are limited in the USVI and are subject to saltwater intrusion and pollution by wastewater and petroleum products (U.S. Virgin Islands Department of Planning and Natural Resources, 2008).

3.7 BIOLOGICAL RESOURCES

Unit of Analysis

Modified Anderson Classifications Within Physiogeographic Regions

3.7.1 Definition of the Resource

Biological resources include organisms, populations, or any other biotic component of ecosystems. Biological resources fall into two broad groupings: flora (plants) and fauna (mammals, birds, reptiles, amphibians, fish, and invertebrates), including their behaviors, assemblages, and interactions within the overall ecosystems within which they are found. Biological diversity is the variability among living organisms and the ecological complexes of which they are part, including diversity within species, between species, and of ecosystems (Convention on Biological Diversity, 2013).

3.7.2 Applicable Statutes and Regulations

The analysis of impacts under NEPA can inform and facilitate compliance with other environmental laws applicable to biological resources as described below. A discussion of the applicable laws and regulations for Biological Resources are provided below.

3.7.2.1 Bald and Golden Eagle Protection Act of 1940

The Bald and Golden Eagle Protection Act of 1940 and amended in 1962 was passed to protect both avian species. The bald eagle was officially adopted as the Nation's symbol in 1782. From that time until 1940, population numbers rapidly declined due to hunting, insecticide use, and habitat loss. To prevent the extinction of the bald eagle, Congress passed the Bald Eagle Act (16 U.S.C. §§668-668d) in 1940 to prohibit the take, possession, sale, purchase, barter, or offer to sell, purchase, or barter, export, or import any part of a bald eagle. In 1962, Congress amended the Bald Eagle Act to include golden eagles, recognizing that the population of the golden eagle had declined at such an alarming rate that it was threatened with extinction. The bald eagle continues to be protected by the Bald and Golden Eagle Protection Act even though it has been delisted under the Endangered Species Act (ESA).

3.7.2.2 Endangered Species Act of 1973

The ESA (16 U.S.C. §1531 et seq.) provides a program for the protection of imperiled species and the ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. Collectively referred to in this NPEIS as the Services, USFWS administers the ESA for terrestrial and freshwater organisms, while NOAA Fisheries administers the ESA primarily for marine wildlife and anadromous fish. Under the ESA, an endangered species is defined as a species currently in danger of becoming extinct, while a threatened species is likely to become endangered in the foreseeable future. Section 7(a)(1) of the ESA mandates that all Federal agencies utilize their existing authorities to further the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Section 7(a)(2) of the ESA requires all Federal agencies to consult with the Services to ensure that any action they fund, authorize, or carry out does not jeopardize the continued survival of any endangered or threatened species or adversely modify designated critical habitat. Section 7(a)(2) generally requires a Federal agency to conduct a biological assessment to identify any endangered or threatened species that are likely to be affected by the agency's action. The result of such assessment may be a determination that the action "may affect, but is not likely to adversely affect" the species, a determination that the action "may affect, and is likely to adversely affect" the species, or a determination that the action "will affect and will jeopardize the continued existence" of the species. Coordination with the Services is required. If the Services concur with an agency's finding that an action "may affect but is not likely to adversely affect" the species, then the consultation is complete. However, if the Services do not concur with such a finding, or if the agency finds that the action is "likely to adversely affect or jeopardize the species," then consultation continues. The Services then use the agency's biological assessment as the basis for developing a Biological Opinion that further analyzes the action's impact on species to determine if jeopardy will occur. If jeopardy or adverse modification of critical habitat is found by the Services, the Services will suggest a "reasonable and prudent alternative" (RPA) to the proposed action that will allow the Federal agency to proceed without jeopardizing the continued survival of ESA-listed species (USFWS & NOAA Fisheries, 1998).

However, even if an RPA may be implemented to avoid jeopardy or adverse modification, it may still result in the take of ESA-listed species. Section 9 of the ESA prohibits the taking of ESA species. Take is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capture, or collection of ESA species, or attempting to engage in any such conduct. Harm includes significant habitat modification or degradation that results in death or injury to ESA species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to ESA species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (50 C.F.R. §17.3). If take will occur from the implementation of an RPA, the Services will develop an incidental take statement to exempt such take from the prohibitions of Section 9 of the ESA.

Section 10 of the ESA provides exceptions to the Section 9 prohibitions. The exceptions most relevant to Section 7 consultations are takings allowed by two kinds of permits issued by the Services: (1) scientific take permits and (2) incidental take permits. The Services can issue permits to take listed species for scientific purposes or to enhance the propagation or survival of listed species. The Services can also issue permits to take listed species incidental to otherwise legal activity.

The take prohibitions of Section 9 of the ESA also apply to non-Federal parties. Section 10(a)(1)(B) of the ESA allows non-Federal parties to apply for an incidental take permit for activities that could result in the incidental taking of ESA-listed species. The application must include a habitat conservation plan that lays out the proposed actions, determines the effects of those actions on ESA species and their habitats, and defines measures to minimize and mitigate adverse effects (USFWS & NOAA Fisheries, 1998).

As stated above, private floodplain development is not FEMA's action, in that FEMA does not authorize, fund, or carry out private floodplain development (except pursuant to the grants programs, which are not within the scope of this NPEIS). Because private floodplain development is not FEMA's action, Section 7 would be inapplicable to these actions. As such, FEMA uses Sections 9 and 10 of the ESA as the authority for requiring participating communities to ensure that project proponents have assessed, and appropriately addressed, any adverse effects of development in the SFHA on ESA-listed species and designated critical habitat, thereby ensuring there is no "take" in violation of Section 9 of the ESA.

3.7.2.3 Magnuson-Stevens Fishery Conservation and Management Act of 1976

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA) (16 U.S.C. §§1801-1882) was enacted to conserve and manage fishery resources along the United States coastlines. Under the MSA, Congress mandated the identification of habitats essential to managed species and measures to conserve and enhance these habitats. Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity… 'Waters' includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle" (NOAA Fisheries, 2004). The MSA requires cooperation among NOAA Fisheries, the eight regional Fishery Management Councils (FMCs), and Federal and State agencies to protect, conserve, and enhance EFH.

Pursuant to Section 303(a)(7) of the MSA (NOAA Fisheries, 2007), regional FMCs must prepare Fishery Management Plans (FMPs) which include the identification of EFH used by all life history stages of each managed species. NOAA Fisheries and the FMCs, under the authority of the Secretary of Commerce, are mandated to describe and identify EFH in each FMP; minimize to the extent practicable the adverse effects of commercial fishing on EFH; and identify other actions to encourage the conservation and enhancement of EFH (50 C.F.R. § 600.805-930). NOAA Fisheries and the regional FMCs also identify Habitat Areas of Particular Concern (NOAA Fisheries, 2015a).

Section 305(b)(2) of the MSA requires a Federal agency to consult with NOAA Fisheries on all activities, or proposed activities, authorized, funded, or undertaken that might adversely affect EFH. As part of the EFH consultation process, Federal agencies must prepare a written EFH Assessment describing the effects of that action on EFH. NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes such as NEPA, Section 7 of the ESA, or the Fish and Wildlife Coordination Act. NOAA Fisheries must provide the Federal agency with EFH consultation recommendations for any action that may adversely affect EFH (50 C.F.R. § 600.805-930).

3.7.2.4 Marine Mammal Protection Act of 1972

The Marine Mammal Protection Act of 1972 (MMPA) (16 U.S.C. §§1361-1407) protects all marine mammals, including whales, dolphins, and porpoises (cetaceans); seals, sea lions, and walruses (pinnipeds); manatees and dugongs (sirenians); sea otters; and polar bears within United States waters. The MMPA makes it illegal to "take" marine mammals without a permit. Under the MMPA, a "take" includes harass, feed, hunt, capture, collect, or kill any marine mammal or part of a marine mammal. NOAA Fisheries manages all cetaceans, seals, and sea lions; USFWS manages walruses, manatees, dugongs, otters, and polar bears. Both USFWS and NOAA Fisheries are the lead Federal agencies implementing the MMPA, and coordination with these agencies is required for actions with the potential to result in a take of a marine mammal within United States waters.

3.7.2.5 Migratory Bird Treaty Act of 1918

Under the Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. §§703-712, as amended), it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg or any such bird, unless authorized under a permit issued by the Secretary of the Interior. Some regulatory exceptions apply. "Take" is defined in the MBTA regulations as "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." The MBTA protects more than 800 species of birds that occur in the United States.

3.7.2.6 EO 11990 (Protection of Wetlands)

EO 11990, *Protection of Wetlands*, requires Federal agencies to minimize the destruction, loss, or degradation of wetlands, including waters of the United States, and to preserve and enhance the natural and beneficial values of wetlands. Before implementing an action that is located in, or may affect, a wetland, this EO requires Federal agencies to demonstrate that there is no practical alternative and the proposed action includes all practical measures to minimize harm to the wetlands. The Federal agency must also provide an opportunity for early public review by those who may be affected and include the findings in environmental or other appropriate decision documents. Projects requiring compliance with this EO are likely to require a permit under Section 404 of the CWA. The USACE has permitting authority over activities affecting waters of the United States. Waters of the United States include surface waters such as navigable waters and their tributaries, all interstate waters and their tributaries, natural lakes, all wetlands adjacent to other waters, and all impoundments of these waters.

3.7.2.7 EO 13112 (Safeguarding the Nation from the Impacts of Invasive Species)

EO 13112, *Safeguarding the Nation from the Impacts of Invasive Species*, requires Federal agencies to actively prevent the introduction and spread of invasive species. This EO also created the Invasive Species Council to implement and oversee proactive planning and develop tangible steps to prevent, eradicate, and control invasive species. (National Invasive Species Information Center, 2016)

3.7.2.8 EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds)

This EO applies to Federal agencies that could affect migratory birds either directly or indirectly. The EO directs Federal agencies to implement the MBTA.

3.7.3 Existing Conditions—Nationwide

This section describes biological resources throughout the Action Area. Flora and fauna throughout the United States are first described in general terms, and then more detail on specific sub-groups of flora/fauna (migratory birds, threatened and endangered species, EFH, and wetlands) is provided. FEMA has adopted a habitat level approach to the description of the baseline condition of biological resources. This is necessarily a high-level approach, given the nationwide extent of the Action Area and the myriad ecological conditions present throughout the United States and its territories.

The original ***Anderson Land Use/Cover Classification System*** describes habitats nationwide in broad, simple terms. Minor modifications have been made to provide a consistent description of biological resources throughout the United States and its territories.

The unit of analysis to describe biological resources is a slightly modified version of *A Land Use and Land Cover Classification System for Use with Remote Sensor Data* (the original Anderson land use/cover classifications) (Anderson, Hardy, Roach, & Witmer, 1976). Anderson et al. describe land use/cover classifications across the United States in broad, simplified terms, which were found to be a suitable and practical method for a nationwide approach to classifying biological resources. Habitat classifications used in this analysis are based on the original Anderson land use/cover classifications (Anderson, Hardy, Roach, & Witmer, 1976), with some minor additions and modifications to the names and descriptions of some classifications to better fit the needs of this analysis. The modified Anderson classifications as described in this document may differ from commonly used terms (rangelands vs grasslands) or similar habitat classifications used for other purposes. For example, "wetlands" as defined in this document are more inclusive than the statutory definition of wetlands applicable to USACE permitting activities under Section 404 of the CWA (see Section 3.7.3.7). Similarly, although forests as commonly defined occur in both upland and lowland areas, "forest land" as defined here includes only upland forests; lowland forests are included within the "forested wetland" classification.

For the purposes of this analysis, slight modifications to the original Anderson land use/cover classifications were made to develop 12 classifications of biological resources throughout the United States and its territories:

- Wetlands – forested and nonforested;
- Fresh Waters – streams and rivers, lakes, estuaries;
- Marine Waters – nearshore and offshore;
- Beaches;
- Barren Lands – inland sandy areas and bare exposed rock;
- Caves;
- Rangelands – herbaceous, shrub and brush, and mixed;
- Forest Lands – deciduous, evergreen, and mixed;
- Perennial Snow or Ice;
- Urban/Built-up Lands;
- Agricultural Lands; and
- Tundra.

SFHA boundaries were used as the demarcation line for a basic segregation of classifications needed to analyze the effects of the Proposed Action, some of which may occur within or outside of SFHAs. The 12 classifications were divided into lowland/aquatic habitats, which generally occur within SFHAs, and upland habitats, which generally do not occur within SFHAs. As part of FEMA's review of the EPA ecoregion approach that was initially considered to classify habitats for biological resources, National Gap Analysis Program (GAP) land cover spatial data (USGS, 2011c) were obtained. The GAP data are based on the NatureServe Ecological Classifications (NatureServe Explorer, 2015). The GAP data were overlaid on a map of Ecoregion 11 (Commission for Environmental Cooperation, 1997) to determine which habitat classes overlapped with SFHAs.

Although this approach proved to be too resource-intensive to be completed for the entire nation, the analysis completed for Ecoregion 11 demonstrates the relationship of the modified Anderson classifications relative to SFHAs, and provides justification for FEMA's determination of which of those classifications typically overlap partially or completely with SFHAs. A more detailed description of this process is included in the Biological Evaluation (BE) prepared for the Preferred Alternative (Appendix C) (FEMA, 2015b). To summarize, FEMA determined that lowland/aquatic habitats are generally associated with inland waterways or coastlines and typically overlap partially or completely with SFHAs. Therefore, the corresponding modified Anderson classifications (wetlands, fresh waters, nearshore marine waters, and beaches) are anticipated to have a high prevalence in SFHAs nationwide. Upland habitats and offshore waters are geographically separated from waterways and coastlines and generally have little to no overlap with SFHAs. Accordingly, the corresponding modified Anderson classifications (barren lands, caves, rangelands, forest lands, perennial snow or ice, and offshore marine waters) are anticipated to have a minimal prevalence in SFHAs nationwide.

FEMA recognizes that there are exceptions to this generalized approach and that upland habitats may sometimes occur within an SFHA. For example, the floodplain of a large river flowing through an upland rangeland habitat could include fringe areas adjacent to the river and within the SFHA but vegetated with the upland plants characteristic of rangelands. However, while upland habitats may occur within SFHAs, their abundance relative to the amount of lowland habitats within SFHAs is anticipated to be minimal nationwide. FEMA initially developed this approach to prepare the BE for the Proposed Action and more detail on how it was used to determine which habitats overlap with SFHAs is provided in the BE (Appendix C) (FEMA, 2015b).

The 12 main modified Anderson classifications as defined in this document and occurrence in SFHAs are provided in Table 3-15.

Table 3-15: Habitat Classifications

Modified Anderson Classification[1] and Habitat Description	Generally occurs in SFHAs?
Wetlands are areas where water is present on or near the ground surface throughout the year or for varying periods of time. Hydrology largely determines how the soil develops and the types of plant and animal communities (both aquatic and terrestrial) which the wetland supports. The prolonged presence of water creates conditions conducive to the growth of specially adapted plants (hydrophytes) and promotes the development of hydric soils. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance (EPA, 2015e). Forested wetlands are perennially or intermittently flooded freshwater and saltwater lowland areas dominated by woody vegetation, such as trees and shrubs. Trees and shrubs present in a forested wetland may be deciduous, coniferous, or a mixture of both, depending upon latitude, elevation, soils, aspect, and other factors. Some typical characteristics of a forested wetland include a complex food web of organisms, canopy cover, leaf litter, hydric soils, hydrophytic vegetation, and the presence of a seasonal or permanent body of water that may be large (rivers, lakes) or small (streams, springs). Forested wetlands include forested riparian areas, mangrove forests, wooded swamps and bogs, and	Yes

Modified Anderson Classification[1] and Habitat Description	Generally occurs in SFHAs?
lowland forested areas with seasonal flooding or water at or near the ground surface for at least part of the year. Examples of forested wetlands are the mangrove forests of Everglades National Park in Florida and the Cypress-Gum Forests of Alligator River National Wildlife Refuge in North Carolina. Nonforested wetlands are perennially or intermittently flooded freshwater or saltwater lowland areas dominated by herbaceous vegetation, such as mosses and emergent plants, or are not vegetated. Some typical characteristics of a nonforested wetland include a complex food web of organisms, open space, hydric soils, hydrophytic vegetation, and permanently or seasonally wet ground cover, possibly including small waterbodies (streams, springs). Nonforested wetlands include freshwater meadows, open bogs, salt marshes, and wet prairies. Trees and shrubs are seldom present in these communities. Examples of these systems include the Florida Everglades, the Midwest Prairie Pothole Region, and Louisiana's Atchafalaya Basin.	
Fresh waters are inland waterways and water bodies that do not contain a large amount of salt. Streams and rivers are freshwater linear bodies of water with perennial or intermittent flows. Streams and rivers are typically found in lowland areas that may be forested, herbaceous, or non-vegetated. Some typical characteristics of streams and rivers include aquatic plants, varying depths, and varying flows. Substrates span a range of materials, including silt, clay, sand, pebbles, cobbles, boulders, and bedrock. The latitude, water temperature, flow velocity, water quality, substrate, depth, width, and abiotic diversity of each stream or river dictate biological composition and diversity. Examples include the Mississippi, Colorado, and Allegheny River systems. Lakes are enclosed bodies of fresh water, either natural or manmade (reservoirs) that have no flow. Some typical characteristics of lakes include aquatic plants and varying depths. Similar to streams and rivers, a variety of abiotic factors dictate the overall biological composition and diversity of lakes. The age and successional stage of smaller lakes, coupled with the complexity of the land-water interface, also influence biological composition. Examples include the Great Lakes and inland lakes and reservoirs such as Lake Mead in Nevada, Lake Texoma in Texas, and Shasta Lake in California. Estuaries extend inland from the sea, where fresh and salt waters mix to create a brackish (slightly salty) aquatic system. Estuaries are typically found in coastal areas where rivers meet marine waters and include areas below the low water line (NOAA, 2015a). Some typical characteristics of estuaries include a productive ecosystem, aquatic plants, brackish water, and a non-enclosed system that provides the interface between freshwater rivers and the ocean. The New Jersey Meadowlands and the San Francisco Bay are examples of this habitat classification.	Yes
Marine waters are salt waters along coastlines and include nearshore (generally within a few hundred feet of the shoreline) or offshore waters of bays and oceans. Some typical characteristics of marine waters include varying depths and substrates, areas of high biodiversity, and large expanses of open water. Examples of marine waters include the Pacific, Atlantic, and Arctic Oceans, as well as the Gulf of Mexico. Nearshore marine waters, due to their proximity to the land-water interface, are typically exposed to more intensive recreational and commercial uses than offshore areas. This habitat includes kelp beds and seagrass beds. Offshore marine water habitat is generally characterized as pelagic or benthic. Pelagic habitat consists of the water column. Benthic habitat refers to the seabottom, which primarily consists of sand, silt, mud, rock, and gravel, but can also include coral reefs.	Yes (nearshore) No (offshore)
Beaches are smooth sloping accumulations of sand, gravel, or rock along coastal shorelines that typically extend from the low water line to the upper extent of the 100-year floodplain. Beaches also include foredunes, or the non-vegetated or slightly vegetated (e.g., beachgrass) sand dunes closest to the shoreline. Some typical characteristics of beaches include a linear expanse of open space and	Yes

Modified Anderson Classification[1] and Habitat Description	Generally occurs in SFHAs?
a neighboring water body. Beaches can be found on the shorelines of marine waters, bays, estuaries, and lakes. Beaches vary in width and slope, and are typically exposed to higher recreational uses and pressures than other habitat classifications. Due to their unique characteristics, beaches also provide essential habitat for the critical life stages of many protected species. Examples of beach habitat include Cape Hatteras National Seashore in North Carolina and Padre Island National Seashore in Texas.	
Barren lands include inland sandy areas and bare exposed rock. Inland sandy areas are accumulations of sand transported by wind. These areas occur in both mesic and arid areas, are usually sparsely vegetated, and have limited ability to support animal and plant life. Some typical characteristics of inland sandy areas include a barren expanse, sand dunes, and well-drained, sandy soils. Inland sandy areas are typically found in central Florida, as well as the west and southwest regions of the contiguous United States. Examples of these habitats include the Great Basin and Chihuahuan Deserts in the western and southwestern United States, respectively. Bare exposed rock habitats are accumulations of rock with sparse vegetative cover and a limited ability to support animal and plant life. Some typical characteristics of bare exposed rock include a barren expanse and generally uneven, steep, and rocky terrain. Bare exposed rock habitat includes exposed bedrock, desert pavement, scarps, talus, slides, volcanic material cover, and rock glaciers. Examples of these habitats are found in Hawai‘i Volcanoes National Park on the island of Hawaii and Glacier National Park in Montana.	Yes
Caves are hollows in the ground, especially those that open more or less horizontally into a hill or mountain and include karst (eroded limestone) caves, lava caves, and abandoned mines. Caves may contain standing or flowing water depending on local aquifers and the hydrologic processes of the area. Some typical characteristics of caves include a cool and dark subterranean environment, speleothems (mineral deposits that form on the cave floor and ceiling), and interconnecting passages (NOAA, 2015b). Small fissures and holes in hills and mountainsides that cannot support a substantial community of organisms are not included in this classification. Examples of cave habitats include Mammoth Cave in Kentucky, Luray Caverns in Pennsylvania, and Caves of Sonora in Texas.	Yes
Rangelands are areas dominated by upland species of grasses and forbs, shrubs and brush, or a mixture of both. Most rangelands are found in the western United States, but they are also present in the central, eastern, and southeastern regions (where they are usually called grasslands), as well as in Alaska. Some typical characteristics of rangelands include open space, short ground cover, and generally varied topography. Herbaceous rangelands are areas dominated by upland species of grasses and forbs. These areas are often called grasslands. Vegetation in herbaceous rangeland primarily includes short and tall grasses, bunch grasses, and desert grasses. Herbaceous rangelands include, but are not limited to, previously used crop or pasture land, prairies, and grasslands. Large expanses of this habitat are found in the Great Plains region of the United States, though much of it has been converted to agricultural lands. Shrub and brush rangelands are areas dominated by upland species of shrubs and brush. Vegetation primarily includes succulents or xeric vegetation with woody stems. Shrub and brush rangelands include, but are not limited to, brushlands, chaparral, and alkali areas. Generally, those ecosystems dominated by low, scrubby, woody vegetation that typically occur in arid and semiarid regions, such as Santa Monica Mountains National Recreation Area in California, are included in this classification. In the east, these systems are former croplands and pasturelands that are now used primarily for grazing. Mixed rangelands are areas dominated by a mixture of upland species of grasses, forbs, shrubs, and brush. Mixed rangelands include, but are not limited to, previously used crop or pasture land,	Yes

Modified Anderson Classification[1] and Habitat Description	Generally occurs in SFHAs?
prairies, and areas of mixed brushlands and grasslands. Those ecosystems where more than one-third of the land is a mixture of herbaceous and shrub or brush rangeland species are considered mixed rangeland.	
Forest lands are areas dominated by upland species of trees. As defined in this document, the forest land habitat classification does not include trees characteristic of forested wetlands. Some typical characteristics of forest lands include canopy cover, leaf litter, and a general lack of water bodies. Deciduous forest lands are areas dominated by upland species of trees that seasonally lose their leaves. Examples of this habitat include the forests of Great Smoky Mountains National Park. Evergreen forest lands are areas dominated by upland species of trees that remain green throughout the year, including tropical hardwoods. An example of this habitat is the Superior National Forest in Minnesota. Mixed forest lands are areas dominated by a mixture of deciduous and evergreen forest. An example of this habitat is the Allegheny National Forest in the eastern mountain region.	Yes
Perennial snow or ice habitats are areas covered by snow, firn (course compacted granular snow), or ice year-round. This habitat features a barren expanse, freezing temperatures, snowbanks, a lack of vegetation, and glaciers. Perennial snow or ice in the United States primarily occurs in Alaska. Examples of this habitat are found in snowcap areas in the mountains and glacial areas like Mendenhall and Worthington glaciers.	No
Urban or built-up lands are areas of intensive human use where much of the land is covered by man-made structures and impervious surfaces. Urban or built-up land includes residential, commercial, industrial, and transportation uses, and typically has little to no natural vegetation and some level of human presence. The urban or built-up land classification includes cities, towns, highways, communication towers, shopping centers, manufacturing plants, and airports.	Yes
Agricultural lands are areas primarily used for the production of food and fiber. Some typical characteristics of agricultural land are farming activities, the use of large, mechanized equipment, and tilled or compacted soil. Agricultural lands include cropland, livestock pastures, orchards, vineyards, greenhouse/nurseries, and confined feeding operations. Agricultural lands typically support large areas of homogenous monocultures. Examples of this habitat include the large stockyards of the Midwest, croplands of the corn belt, and those areas of mixed agriculture/livestock across the United States.	Yes
Tundra is composed of treeless regions beyond the limit of the boreal forest and above the tree line in mountain ranges (tundra literally means "treeless plane"). Tundra vegetation includes woody shrubs and brush, sedges, grasses, and mosses. Some characteristics of tundra habitat include a permafrost layer in the soil, short and scarce vegetative cover, and freezing temperatures. The characteristics of tundra include extremely low temperatures, little precipitation, poor nutrients, and short growing seasons. Dead organic material functions as a limited nutrient pool, with the major nutrients being nitrogen and phosphorous. As the coldest of all biomes, tundra generally supports low biotic diversity, simple vegetation structure, and large population oscillations based on weather. Tundra in the United States primarily occurs in Alaska along the northern and northwestern coastlines and regions, such as Bering Land Bridge National Preserve.	Yes

[1] Classifications are adapted from the original Anderson land use/cover classifications (Anderson, Hardy, Roach, & Witmer, 1976), with minor modifications.

Urban/built-up lands (neighborhoods, towns, and cities with streets, residences, commercial building, park lands, etc.) typically do not support dynamic and substantial biological communities. Developed areas and urban landscaping provide little ecological benefit to most plant and animal species, although some species can adapt to sparse natural resources associated within urban environments (Lowry, Lill, & Wong, 2013). Generally, wildlife and vegetative communities in urban/built-up lands tend to support a lower density and diversity of species and a reduction of quality and quantity of ecological resources (Lowry, Lill, & Wong, 2013). Therefore, the urban/built-up classification is not addressed in this section as a biological resource but is described instead in Section 3.4.3.2, Developed Land.

3.7.3.1 Physiogeographic Regions

The Action Area was divided into broad physiogeographic regions to facilitate a more concise description of the myriad of biological resources found throughout the United States and its territories. Similar to the physiographic regions presented in Section 3.5, these physiogeographic regions are used for biological resources because they are descriptive and intended to broadly characterize the United States. Therefore, the modified Anderson classifications within each region can more accurately describe the varied biological resources that occur throughout the Action Area. The factors considered in developing the physiographic regions for biological resources included:

- Topography (e.g., Mountains, Great Plains, Pacific Coast) (Natural Resources Conservation Service, 1999) (USGS, 1968) (USGS, 2002);
- Climate (e.g., Alaskan Arctic Plain, Arid West/Southwest, Subtropical Islands) (PRISM Climate Group, 2015) (USGS, 2012h);
- Commonly referenced geographic regions (e.g., Great Plains, Mountain Regions, Arid West/Southwest, Subtropical Islands) (USGS, 2002);
- Watersheds (e.g., Great Lakes watershed, Mississippi watershed) (EPA, 2015f) (Natural Resources Conservation Service, 2014);
- Coastal Interface (e.g., Great Lakes, Atlantic Coast, Pacific Coast) (USGS, 2002);
- Flood disaster character (e.g., hurricanes, riverine flooding) (FEMA, 2011b); and
- Distribution of karst geology (where caves are more likely to occur) (Weary & Doctor, 2014).

The physiogeographic regions were developed specifically to describe biological resources and therefore differ from regional classifications utilized in other sections of this document. In Section 3.5, Geology and Soils and Section 3.9, Aesthetics/Visual Resources, physiographic regions are defined by common geomorphology, rock type, and geologic history, and lack the climate and waterbody interface needed to characterize biological resources. Many of the other resource sections in this document use the FEMA regions to describe the Action Area. However, the boundaries of the FEMA regions are based on political boundaries (State lines) and would not be an effective tool for describing biological resources.

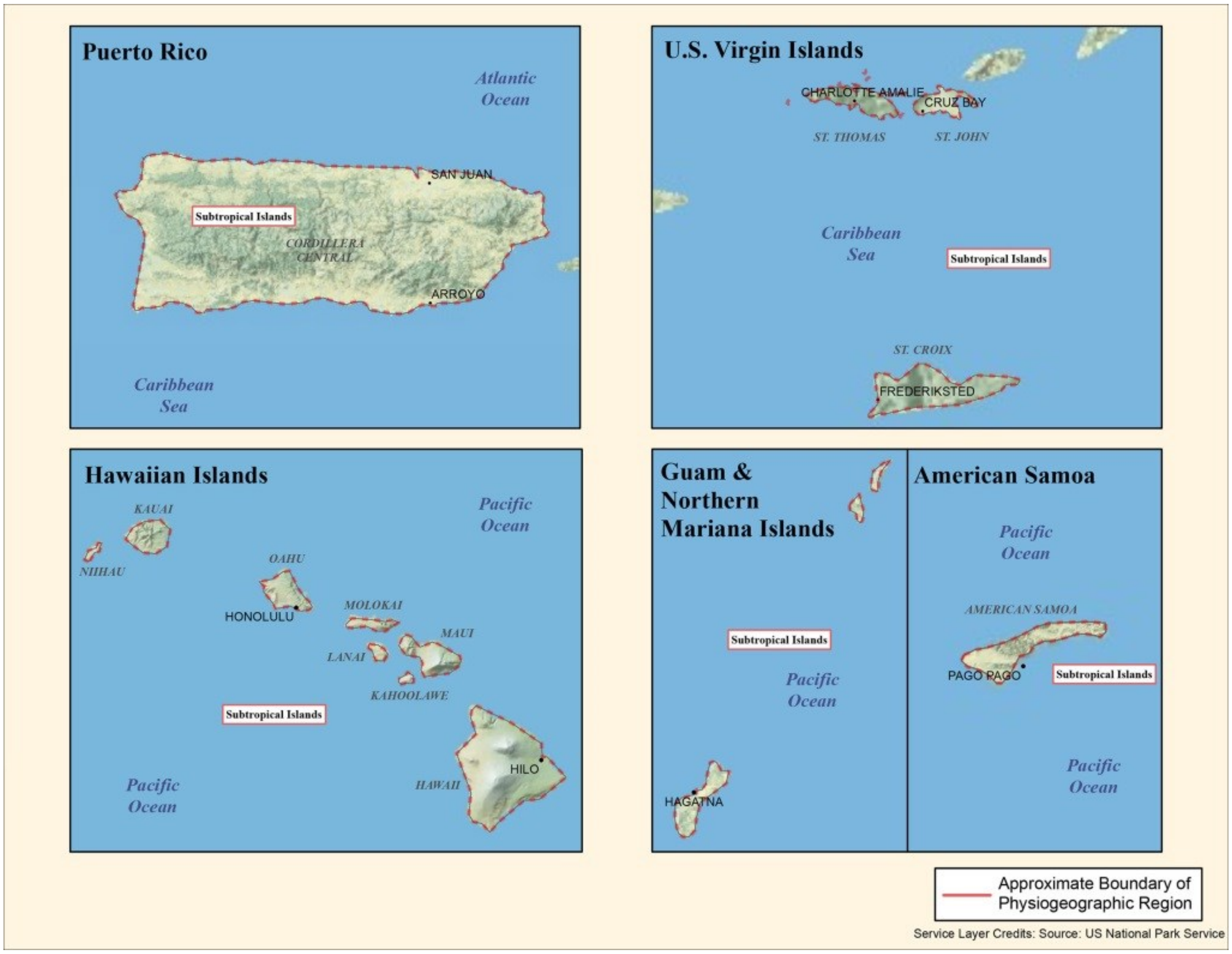
The physiogeographic regions developed are broad enough to provide coverage of the nation; the modified Anderson classifications describe the existing biological resources within those regions. The physiogeographic regions are described in Table 3-16 and approximate boundaries of the regions are shown on Figure 3-16 and Figure 3-17.

Table 3-16: Physiogeographic Regions for Biological Resources

Physiogeographic Region	Description
Alaskan Arctic Plain	The Alaskan Arctic Plain region includes the northwestern portion of Alaska, and is the only region that occurs entirely above the treeline. This region is loosely bound by the mountain ranges of central Alaska to the south and by the Arctic Ocean to the north. The Alaskan Arctic Plain is composed of areas of flat land and rolling hills often underlined by permafrost; the region is characterized by a very short growing season and extremely cold winters. Large areas of the Alaskan Arctic Plain are covered in snow or ice year-round.
Subtropical Island	This region includes islands the United States territories of Puerto Rico, the Marshall Islands, Guam, and USVI in the Atlantic Ocean and Caribbean Sea and the Hawaiian Islands in the Pacific Ocean. These islands are characterized by hot and humid summers, mild winters, and low to high levels of rainfall (depending on altitude and aspect to prevailing weather). The waters along shorelines of subtropical islands include productive and diverse coral reefs.
Mountain	The Mountains region contains all of the major mountain ranges in North America. These include the Appalachian Mountains in the eastern states, the Rocky Mountains of the western interior United States, the Sierra Nevadas along the border of California and Nevada, the Cascades in Oregon and Washington, the Alaska Range in southern Alaska, and the Brooks Range in northern Alaska. This region includes both the high rugged ranges of the western states, as well as the lower, more rounded mountains in the eastern states. Barren peaks are a visually prominent feature of mountains. The Mountains region generally has poor soils and is not well-suited for agriculture, although soils are better developed on flat plateaus or along river valleys in the foothills of mountains.
Pacific Coast	The Pacific Coast region stretches from southern California north through Oregon and Washington, includes the coastline of Alaska south of the Bering Strait (including the Aleutian Islands and panhandle), and extends from the coast eastward to the adjoining Mountains region (the Sierra Nevada, Cascades, and Alaska Range). The Pacific Coast region is composed of relatively rugged terrain heavily influenced by oceanic weather patterns that moderate temperatures and provide moisture. The majority of the coastline is rocky with steep bluffs. The Pacific Coast region is geologically active, with volcanoes located in the Cascade Range and earthquakes occurring in the San Andreas Fault in California.
Atlantic/Gulf Coast	The Atlantic/Gulf Coast region stretches from the coast of Maine southward along the Atlantic seaboard, and includes Florida and the coastline of the Gulf states, including Texas and the Mississippi River Delta. The inland extent of this region is westward to the Appalachian Mountains of the Mountains region and northward from the Gulf to the Great Plains region. The Atlantic/Gulf Coast region has a flat to rolling topography. Most of the Atlantic/Gulf Coast region slopes gently at the coastline and is bordered by extensive, but narrow, sandy beaches; the New England coastline is rocky and more rugged.
Arid West/ Southwest	This region includes the deserts of the southwestern states and the Colorado Plateau, as well as the arid intermountain basins between the Rocky Mountains and the Sierra Nevada and Cascades. This region is dominated by large, open swaths of vegetation (typified by sagebrush in the northern portion and cacti scrub in the southern portion), wind-blown sand deposits, bare rock outcrops, and salt pans that occasionally hold water.
Great Plains	The Great Plains region includes the central portion of the continental United States from central Texas to North Dakota. This region has generally flat to rolling topography; however, steep areas are present where waterways have incised the edges of plateaus (these areas are commonly referred to as badlands). This region also contains the Mississippi and Missouri River systems.
Great Lakes	The Great Lakes region includes the Great Lakes themselves and the surrounding land area, which drains into them. Together, these lakes represent the largest freshwater system in the world. The lands surrounding the lakes have generally flat to rolling topography.

Source: (ESRI, 2016)

Figure 3-16: Physiogeographic Regions for Biological Resources (Continental United States)



Source: (ESRI, 2016)

Figure 3-17: Physiogeographic Regions for Biological Resources (United States Islands and Territories)

3.7.3.1.1 Relative Dominance of Modified Anderson Classifications within Physiogeographic Regions

To refine the descriptions of biological resources across the nation, it was necessary to first determine the presence and relative abundance of the modified Anderson classifications within each physiogeographic region. The NLCD 2011 provides a visual, color-coded representation of land cover types throughout the United States (MRLC, 2015). The Multi-Resolution Land Characteristics Consortium (MRLC) has created an Evaluation, Visualization, and Analysis (EVA) tool to provide numerical and graphical representations (in square miles) of the land cover types in each State (MRLC, 2014). Both the NLCD and the EVA tool are based on the original Anderson land use/cover classifications (Anderson, Hardy, Roach, & Witmer, 1976). Using the NLCD 2011 maps and the EVA tool, FEMA selected representative states from each physiogeographic region and then determined relative dominance of the modified Anderson classifications in the representative states using the *50/20 Rule*.

The *50/20 Rule* is an established procedure recognized by the USACE as the recommended method for selecting dominant species of plants within a defined area. The *50/20 Rule* determines the percent coverage of a defined area by each plant species present, and results in a cumulative coverage total. Once the percent coverage of each species has been determined, dominant species can be identified (USACE, 1987). We substituted land classifications for species and used the same parameters to determine relative dominance of land classifications instead of species. Using the *50/20 Rule*, each physiogeographic region was evaluated for percent coverage of each modified Anderson classification, with the dominant classifications being those which, in descending order of percent coverage, account for 50 percent or more total coverage, and those whose coverage alone accounts for at least 20 percent of the physiogeographic region.

Table 3-17 shows the presence and relative dominance of modified Anderson classifications within each of the physiogeographic regions.

Table 3-17: Presence and Relative Dominance of Modified Anderson Classifications within Physiogeographic Regions

	Modified Anderson Classification[1]											
Physiogeographic Region	Wetlands	Fresh Waters	Marine Waters	Beaches	Barren Lands	Caves	Rangelands	Forest Lands	Perennial Snow or Ice	Urban/Built-up Lands	Agricultural Lands	Tundra
Alaskan Arctic Plain	⦸	⦸	⦸	⦸	⊗	○	○	○	⊗	NA	○	⊗
Subtropical Islands	⊗	⦸	⦸	⦸	⊗	⦸	⦸	⊗	○	NA	⦸	○
Mountains	⊗	⊗	○	○	⊗	⦸	⊗	⊗	⦸	NA	⦸	⦸
Pacific Coast	⦸	⦸	⦸	⦸	⦸	⦸	⊗	⊗	⦸	NA	⊗	⦸
Atlantic/Gulf Coast	⊗	⊗	⦸	⦸	⦸	⦸	⦸	⊗	○	NA	⊗	○
Arid West/ Southwest	⦸	⦸	○	○	⦸	⦸	⊗	⦸	○	NA	⦸	○
Great Plains	⦸	⦸	○	○	⦸	⦸	⊗	⊗	○	NA	⊗	○
Great Lakes	⊗	⊗	○	⦸	⦸	⦸	⦸	⊗	○	NA	⊗	○

[1] Classifications are adapted from the original Anderson land use/cover classifications (Anderson, Hardy, Roach, & Witmer, 1976), with minor modifications.

⊗ = Present and dominant in that physiogeographic region
⦸ = Present but not dominant in that physiogeographic region
○ = Not present in that physiogeographic region
NA = Not addressed

3.7.3.2 General Flora and Fauna

This section provides brief discussions and examples of native and introduced flora and fauna that occur in the dominant and non-dominant modified Anderson classifications within each physiogeographic region for biological resources. For each, a representative threat to the flora and fauna within that region is also briefly described.

Descriptions of flora and fauna are based largely on information presented within the Commission for Environmental Cooperation's *Ecological Regions of North America: Toward a Common Perspective* (Commission for Environmental Cooperation, 1997) and Anderson et al.'s *A Land Use and Land Cover Classification System for Use with Remote Sensor Data* (Anderson, Hardy, Roach, & Witmer, 1976). These two primary references, for the sake of brevity, are not cited in each description below, and can be assumed to have been the source of the information provided unless otherwise noted.

3.7.3.2.1 Alaskan Arctic Plain Physiogeographic Region

Barren lands, perennial snow or ice, and tundra are the dominant classifications in the Alaskan arctic plain. Barren lands in this region are areas of bare, exposed rock with little to no vegetative cover, such as exposed bedrock or rock glaciers. Floral communities are precluded by the harsh, freezing climate and lack of soil. If vegetation is present, it typically consists of short, widely spaced scrub and shrub growing out of the gaps and cracks in the rock. Perennial snow and ice is ground covered by snow and/or ice year-round, characterized by a barren expanse, freezing temperatures, snowbanks, and glaciers. The ground cover consists of snow, firn (course compacted granular snow), or ice. Perennial snow and ice tends to border tundra, barren land, or water; floral communities are not present. Tundra is a treeless area of flat lands or rolling hills often underlain by permafrost. Floral communities in tundra are limited not only by the harsh, freezing climate, but also by the frozen soil layer (permafrost) beneath the ground surface. While communities of lichens, mosses, grasses, and shrub species occur, this layer blocks the growth of deeper roots and thereby prevents the establishment of tree species.

Wildlife species within the Alaskan arctic plain are adapted to the extreme cold and minimal vegetation present. Representative species of wildlife include polar bear, grizzly bear, snowy owl, caribou, arctic fox, and lemming. The tundra is also a major breeding and nesting ground for waterfowl such as tundra swan, trumpeter swan, lesser snow goose, and mallard. During the long, harsh winter wildlife in this region typically migrate to warmer areas or hibernate.

Wetlands, fresh waters, marine waters, and beaches are the non-dominant classifications in the Alaskan arctic plain.

Wetlands (vernal pools, bogs, fens, and marshes) form in lowland areas during snow melts and rainfall events. Vegetation is adapted to cold, wet, and harsh environments, such as brown moss, sphagnum moss, sawgrass, marsh marigold, menyanthes, and horsetail (Viereck, Dyrness, Batten, & Wenzlick, 1992). Representative wildlife species are blackflies, tadpole shrimp, Daphnia, springtail, lesser yellowlegs, short-billed dowitcher, and moose.

Fresh waters of the Alaskan arctic plain typically include small streams and rivers that seasonally flow across the landscape as a result of snow melt or rainfall events. Small, nonforested freshwater lakes also dot the tundra landscape, with aquatic vegetation such as pondweed, water milfoil, burreed, and aquatic buttercup; algae grows on the rocks and cobbles in the water (Viereck, Dyrness, Batten, & Wenzlick, 1992). Arctic char, grayling, three-spined stickleback, red-throated loon, whistling swan, and various species of aquatic invertebrates are found in the fresh waters of this region.

Marine waters in the Alaskan arctic plain region include the nearshore and offshore marine waters of the Arctic Ocean. These waters are very cold—between 28 and 30 degrees Fahrenheit (ºF) at the water surface—and provide a unique environment for organisms adapted to survive in these conditions (NOAA, 2013c). Vegetation found in these marine waters includes eelgrass and several species of marine algae (Viereck, Dyrness, Batten, & Wenzlick, 1992). Offshore waters of the Arctic Ocean support beluga whale, narwhal, and short-tailed albatross; nearshore water species include Steller's eider, arctic tern, walrus, harp seal, bearded seals, and ringed seals.

Beaches in this physiogeographic region are typically rocky, linear expanses along the coastline of the Arctic Ocean. Marine birds breed and nest and seals and walrus breed and rest on these beaches.

3.7.3.2.2 Subtropical Islands Physiogeographic Region

Wetlands, barren lands, and forest lands are the dominant classifications within subtropical islands, which typically have a wet and humid climate. Flora and fauna in this physiogeographic region are often unique and endemic to the islands on which they are found, due to the biological isolation and geographic remoteness characteristic of islands (Raffaele & Wiley, 2014).

Wetlands in the subtropical islands are typically forested swamps and coastal marshes found near the coastline. Mangrove trees, ferns, and bromeliads dominate the floral communities, which are lush and green year-round and support many species of waterfowl, kingfishers, warblers, and dragonflies (Raffaele & Wiley, 2014) (USFWS, 2013a).

Barren lands are primarily located on the islands of Hawaii, which has large areas of bare, exposed volcanic rock; the rugged terrain and lack of soil preclude development of floral communities. The limited vegetation found in these areas grows out of the crevices and fissures in the rock formed after lava solidifies and includes lichen, hardy ferns, and short, woody shrubs. Wildlife is similarly limited in these areas, although some invertebrates, such as crickets or wolf spiders, live in the crevices and fissures of the rock (USGS, 1999b).

Forest lands in subtropical islands have nearly complete canopy cover from broadleaved hardwood and evergreen trees and are typically found in the islands' interiors. The understory comprises epiphytes, ferns, and flowering plants such as bromeliads and orchids. Forests on subtropical islands support a unique and rich diversity of wildlife including parrots, Rhesus monkeys, honeycreeper, boa constrictor, brown tree snake, mongoose, fruit bat, feral pigs, lizards, land crabs, and the Coqui frog (Raffaele & Wiley, 2014) (NPS, 2015c) (USFWS, 2013a).

Fresh waters, marine waters, beaches, caves, rangelands, and agricultural lands are the non-dominant classes on subtropical islands and are typically found in the islands' interiors.

Fresh waters on subtropical islands include lakes, streams, rivers, and estuaries. These fresh water provide nesting areas for island water birds, such as ruddy duck, blue-winged teal, Caribbean coot, great egret, and yellow-crowned night-heron. These waters also support wildlife such as Puerto Rican slider, Caribbean freshwater shrimp, Puerto Rican freshwater crab, flathead gray mullet, and Hawaiian freshwater goby (USFWS, 2015c) (USFWS, 2014).

Marine waters surrounding subtropical islands, both nearshore and offshore, are typically warm (between 77 and 82 °F at the sea surface) and, when not impacted by sediment or turbidity, are very clear (NOAA, 2013c). Some marine waters in this physiogeographic region contain coral reefs, which typically are areas of high biodiversity and ecological richness. Nearshore waters support wildlife such as octopus, queen conch, sea turtles, manta rays, and Antillean manatees which eat and find shelter in seagrasses, corals, sponges, and anemones. Offshore marine waters support blue whale, fin whale, humpback whale, sperm whale, orcas, and various dolphin species (USFWS, 2015c) (USFWS, 2015d).

Beaches in this physiogeographic region are typically sandy, linear areas dotted with endemic beach grasses, shrubs, and palms, which provide nesting areas for sea turtles and habitat for monk seals, spotted sandpiper, bristle-thighed curlew, fiddler crab, and ghost crab (USFWS, 2015c) (USFWS, 2015d).

Caves on subtropical islands include lava tubes and limestone cave systems that typically do not contain vegetation, except near cave entrances where lush communities of ferns and mosses occur. Wildlife in caves, such as the Kauai cave wolf spider, big brown bat, velvety free-tailed bat, Antillean cave bat, Mariana swiftlet, and Kauai cave amphipod are adapted to dark and damp environments (USFWS, 2000) (USFWS, 2012a) (Alexander & Geluso, 2013).

Rangelands on subtropical islands consist of flat, dry, herbaceous grasslands and areas of abandoned cropland or pasture land which support short and long grasses and legumes, with some scattered trees and palms. Wildlife found here includes anoles, ravens, rats, Hawaiian goose, Lanai Mouflon sheep, and the Hawaiian hawk (Raffaele & Wiley, 2014) (Hawaii Department of Land and Natural Resources, 2015) (USFWS, 2012b).

Agricultural lands in this region consist of cropland and pasture land. Sugarcane, coffee, bananas, and pineapples thrive in subtropical environments; pasture land in the region is typically used for grazing by cattle, sheep, or goats (U.S. Department of Agriculture, 2015b) (U.S. Department of Agriculture, 2015c).

3.7.3.2.3 Mountains Physiogeographic Region

Wetlands, fresh waters, barren lands, rangelands, and forest lands dominate this physiogeographic region. Narrow strands of wooded wetlands and riparian areas occur along freshwater mountain streams and rivers. Areas with poor drainage in the mountain region allow the growth of forested wetlands of river birch, cottonwood, alder, bog sedge, larkspur, and bittercress; mosses and ferns grow in nonforested bogs. Mountain wetlands support many species of songbirds, as well as mink, beaver, and moose.

Many fresh waters originate at high elevations in this region and are formed from melting mountain-top snow, rainfall, or ground-fed springs. Headwaters form tributaries that meander down the mountain side, eventually merging into freshwater streams and rivers. Mountain fresh waters are found on steep gradients; the waters of these shaded streams or rivers typically contain large, boulder-sized rocks and organic matter which support algal growth. Fresh waters support minnows, crayfish, brook trout, northern dusky salamander, northern water snake, eastern red-spotted newt, Blanding's turtle, freshwater mussels, and aquatic insects.

Barren lands are areas with bare, exposed rock and sparse vegetative cover. Scattered grasses and small shrubs grow out of the crevices of boulders or bedrock. Bighorn sheep, mountain goats, and musk ox are well-adapted for traversing the generally uneven, steep, and rocky environment of these barren lands (USFWS, 2007b) (Alaska Department of Fish and Game, 2015). Snails, beetles, grasshoppers, flies, and butterflies feed on the detritus or vegetation in between rock crevices (USFWS, 1998).

Rangelands of scrub, brush, and grassland are found in mountain ranges in the western contiguous United States. Chaparral is dominant on the slopes of the Sierra Nevadas, with patches of sagebrush, buckbrush, chemise, and oak trees. Conifers, such as pine, fir, and hemlock, are typically found on the upper Sierra Nevada slopes at high elevations. These areas support gray fox, garter snake, wild turkey, turkey vulture, black bear, ground squirrel, hoary marmot, and various butterflies.

Forest lands in the mountain physiogeographic region include evergreen, deciduous, and mixed forest types. In the Appalachian Range, oak and hickory forests dominate; while in the Rocky Mountain Range, both evergreen and deciduous forests made up of pine, spruce, fir, aspen, and cottonwood are present. Sub-alpine forests, such as those in the Cascade Range, are characterized by coniferous mountain hemlock, amabilis fir, lodgepole pine, and Engelmann spruce. In Alaska, alpine and boreal forests are dominated by coniferous trees such as spruce, fir, and pine, although some deciduous trees, such as alder, birch, and aspen, are also present. Various lichens, shrubs, and forbs make up the understory of mountain forests. Forest lands in the mountains support a diverse assemblage of species; for example, woodland caribou, white-tailed deer, black bear, raccoon, marten, fisher, striped skunk, lynx, bobcat, eastern chipmunk, boreal owl, great horned owl, blue jay, and evening grosbeak.

Caves, perennial snow or ice, agricultural lands, and tundra are non-dominant classes of the mountain physiogeographic region. Caves, while not a major component of any physiogeographic region, are more common in the mountains than in other regions. Caves in the mountains include limestone caves, lava tubes, and talus and fissure caves (surface gaps in boulders and bedrock). Caves often provide habitat for unique species that have adapted to living in a damp and dark environment, such as cavefish, cave-adapted arthropods, and various species of bats. Vegetation is not typically found in mountain caves, except at cave entrances where ferns or shrubs grow out of the cracks and crevices in the rock (NPS, 2016a).

Perennial snow or ice in this region is found only at the highest elevations. The climate here is cold, windy, and harsh; some short grasses emerge through the snow in warmer months, although vegetation is sparse. No wildlife lives here year-round, although some species, such as snowshoe hare and lynx, pass through these areas while moving throughout their ranges (USFWS, Pennsylvania Field Office, 2001).

Agricultural lands in this region are primarily grazing areas for horses, cattle, sheep, and goats; crops include hay, row crops, and orchards in the Appalachian Range, and hay and grapes in the Sierra Nevada Range. Agriculture is not dominant in the mountain physiogeographic region because steep slopes and sometimes rocky soils make farming difficult.

Tundra occurs in the Mountain physiogeographic region only in Alaska. Tundra in the mountain region is very similar to tundra in the Alaskan arctic plain region, but occurs at slightly higher elevations. Lichens, mosses, grasses, and shrub species are the dominant plants since the permafrost layer hinders the establishment of tree species. Representative wildlife species include grizzly bear, caribou, and arctic fox.

3.7.3.2.4 Pacific Coast Physiogeographic Region

Rangelands, forest lands, and agricultural lands dominate the Pacific Coast physiogeographic region. Rangelands in the southern portion of this physiogeographic region are vegetated mostly with shrubs, including chaparral, big sagebrush, rabbit brush, and antelope brush, with interspersed patches of grassland. Many of the plants are resistant to water loss and form a cover of closely spaced shrubs. These rangelands support coyote, red fox, mule deer, calliope hummingbird, yellow-billed magpie, tricolored blackbird, and various species of butterfly (USGS, 1998). In the northern portion of the Pacific Coast region, including the Aleutian Islands and the coast of Alaska, the conditions are too severe for most woody plants, except in dwarf form. Northern rangeland in this region is dominated by shrubs, herbs, mosses, and lichens. Representative wildlife of the northern Pacific Coast rangeland include sandhill crane, grasshopper, long-nosed snake, sage thrasher, red-tailed hawk, and black-tailed jack rabbit (USGS, 1998).

Forest lands in the Pacific Coast physiogeographic region are primarily coniferous. The dominant plant communities include mixtures of western red cedar, yellow cedar, western hemlock, Douglas fir, amabilis fir, Sitka spruce, California redwood, Ponderosa pine, and lodgepole pine. Many trees here are very old and large, forming old growth stands. Stands of deciduous trees, such as red alder and trembling aspen, also occur here. Garry oak, Pacific madrone, and Douglas fir are found in the drier, mountain rain-shadow areas. In the southern oak woodland of California, California walnut and Engelmann oak are dominant, along with Monterey cypress, Monterey pine, and Torrey pine. Characteristic wildlife in this region include mule deer, black-tailed deer, elk, moose, coyote, wolf, black bear, grizzly bear, raccoon, Columbian ground squirrel, Steller's jay, blue grouse, several species of songbirds, and raptors.

Agricultural lands in this physiogeographic region are primarily located in the Central and Salinas Valleys of California. In the Central Valley, rice, almonds, apricots, peaches, cherries, olives, sugar beets, wheat, hay, prunes, tomatoes, grapes, and cotton are common crops. Crops in the Salinas Valley consist of artichokes, lettuce, brussel sprouts, vegetables, citrus fruit, and avocado. Cattle ranches are also present in the agricultural areas of California. Outside of California, agricultural lands in the Pacific Coast region occur along rivers and streams. Wildlife in these agricultural lands primarily include waterfowl and other birds that use the crop or pasture land as a stop-over site during migration or as a regular food source (Pocewicz, Estes-Zumpf, Anderson, Copeland, & Keinath, 2013).

Wetlands, fresh waters, marine waters, beaches, barren lands, caves, perennial snow or ice, and tundra are the non-dominant classes of the Pacific Coast physiogeographic region. Wetlands, such as riparian forests, salt marshes, and bogs, dot the landscape in the Pacific Coast region and provide habitat for such wildlife as garter snakes, western pond turtle, and Pacific marsh shrew (USGS, 1998). These wetlands are either forested, with trees such as cottonwood, alder, cedars, and willows, or nonforested, with herbaceous flora like sweetflag, foxtail, and northern water plantain. Vernal pools in California's San

Joaquin and Central Valley provide habitat for some specialized and endemic plant species such as hogwallow starfish, marsilea fern, toad rush, California goldfields, and meadow foam (USGS, 1998).

Fresh waters in this region include streams, lakes, rivers, and estuaries. Streams vary from steep, straight, fast-flowing mountain drainages, to braided, meandering channels (Carstensen, Richard, 2007a). Estuaries along the coastline provide habitat for several species of migrating birds, small fish, shellfish, and coastal mammals (NOAA, 2015a). Anadromous species, such as the five species of Pacific salmon, are a prevalent component in coastal waterways as they return to freshwater to spawn (Carstensen, Richard, 2007a).

Marine waters off the Pacific Coast typically vary in temperature from about 63 ºF off the coast of southern California, to about 29 ºF off the southern coast of Alaska (NOAA, 2013c). The nearshore waters are rich in marine life due to the combination of freshwater from coastal rivers and the up-welling of marine nutrients. Rocky reefs, kelp forests, and seagrass beds provide shelter, foraging grounds, and nurseries for an abundance of wildlife species (Oceana, 2011). Faunal species, such as the southern sea otter and green sea turtle, require the warmer Pacific waters to survive. The colder waters provide a unique and distinct environment that is necessary for certain species of wildlife, such as orcas and other whales, several species of salmon, seals, and sea lions. Seabirds are abundant in the marine waters of this region as well, and typically include puffins, petrels, gulls, mures, cormorants, and marbled murrelets.

Beaches along the Pacific Coast are typically either sandy or rocky. Sandy beaches are predominantly located in the south, such as central and southern California, while rocky beaches are most common in the north, such as northern California to southwest Alaska (California Sea Grant, 2015a) (Carstensen, Coastal Habitats of Southeast Alaska, 2007b). Pacific Coast beaches often contain washed-up kelp (known as wrack), which is a foundation of the beach ecosystem. Wrack is consumed by many sand-dwelling invertebrates, that are then eaten by various species of birds, such as plovers and sanderlings (California Sea Grant, 2015a). Other representative fauna on Pacific beaches include northern elephant seals, California sea lions, sea otters, Pacific harbor seals, hermit crabs, and herons (California Sea Grant, 2015b) (Carstensen, Coastal Habitats of Southeast Alaska, 2007b). Due to harsh tidal conditions, most vegetation cannot survive in beach habitat. However, some species of flora have adapted to survive at the top of sandy beaches, which begins the process of sand dune development, or in pockets of soil on rocky beaches (California Sea Grant, 2015c) (Carstensen, Coastal Habitats of Southeast Alaska, 2007b). Examples of these plant species include milk-vetch, spineflower, goosetongue, and beach spinach (California Sea Grant, 2015c) (Carstensen, Coastal Habitats of Southeast Alaska, 2007b).

Barren lands exist in this physiogeographic region in the form of coastal cliffs and bluffs. These steep, rocky, exposed substrates are often unstable, and are subject to harsh wind and wave action. Vegetation is mostly absent, but is occasionally present in the form of sparse grass, forb, shrub, or lichen cover (Washington Department of Fish and Wildlife, 2016). Many species of birds nest in these cliffs, including cormorants, puffins, common murres, gulls, and oystercatchers. Terrestrial species, such as bears, deer, and elk, are present in the cliffs on occasion (USFWS, 2015e).

Caves in the Pacific Coast region occur in karst topographies and often conduct ground water. Brown bears use caves as dens; little brown bats, silver-haired bats, and California myotis use caves for roosting (Carstensen, Terrestrial Habitats of Southeast Alaska, 2007c). A few plants, such as lichen and algae, survive in the portions of sea caves that are exposed to sunlight (NPS, 2015d).

Perennial snow and ice exists in this region as glaciers along the coast of Alaska. These rivers of ice often encompass many square miles. Generally, these areas only support transient wildlife species and no vegetation. However, ice worms live in the glaciers, and algae are present in the dust that accumulates on the ice (Takeuchi, Kohshima, & Segawa, 2003) (NPS, 2015e).

Tundra in the Pacific Coast region is an extension of the tundra in the Alaskan Artic Plain (described above).

3.7.3.2.5 Atlantic/Gulf Coast Physiogeographic Region

Wetlands, fresh waters, forest lands, and agricultural lands dominate the Atlantic/Gulf Coast physiogeographic region.

Wetlands include forested swamps with deciduous and coniferous mixed communities, supporting tree species such as eastern hemlock, black ash, red maple, swamp white oak, and smooth alder. Nonforested salt marshes are common along the coastlines and are characterized by salt-tolerant plants such as cordgrass, saltgrass, and glasswort (USFWS, 2016). Representative wildlife species utilizing the wetlands of this region include red-winged blackbird, marsh wren, kingfisher, muskrat, cottonmouth, and clapper rail (USFWS, 1987). Wetlands in the southern tip of the Florida peninsula include mangrove swamps; these wetlands are more similar to wetlands that occur in the Subtropical Islands physiogeographic region. Key deer, Florida panther, manatee, alligator, American crocodile, and several species of amphibians are typical wildlife in these mangrove swamps.

Fresh waters in this physiogeographic region include rivers, streams, lakes, and estuaries. Freshwater vegetation includes several species of emergent and sub-emergent plants, such as duckweed, water lilies, cattails, and arrowhead. Aquatic and semi-aquatic wildlife in these areas include walleye, northern pike, brook trout, muskellunge, beaver, and river otter. Waterfowl and water birds that occur in the fresh waters of this region include brown pelican, mallards, wood stork, ibis, and heron. (New York State Department of Environmental Conservation, 2016) (Virginia Department of Game and Inland Fisheries, 2016)

Forest lands in this region typically have a dense canopy consisting mostly of tall, broadleaf, deciduous trees, as well as needle-leaf conifers. While oaks, hickories, maples, and pines are common; other wide-ranging tree species include ashes, elms, black cherry, yellow poplar, sweet gum, basswood, hackberry, common persimmon, eastern red cedar, and flowering dogwood. This region supports closed stands of conifers, primarily including white and black spruce, jack pine, balsam fir, and tamarack. Many shrub, vine, and herb species thrive under the canopy. Forest wildlife species within this region are diverse and plentiful due to the large areas of contiguous habitat, coupled with a mild climate, and include birds, fish, reptiles, and amphibians. Mammals present in these forests include white-footed mouse, gray squirrel, eastern chipmunk, raccoon, porcupine, gray fox, bobcat, white-tailed deer, and black bear.

Agricultural lands in this region primarily consist of grazing areas and feed operations for dairy cows, beef cattle, poultry, and pigs. Hay is the major crop of this region, grown to feed livestock (U.S. Department of Agriculture, 2015a). Row crops, such as soybean, cotton, tobacco, and corn, can also be found in this physiogeographic region. Near the Gulf coast, pine plantations used to produce pulp and paper are common. Wildlife found on the agricultural lands of the Atlantic/Gulf coast region primarily include waterfowl and other birds that use the crop and pasture land as a stop-over site during migration or as a food source (Pocewicz, Estes-Zumpf, Anderson, Copeland, & Keinath, 2013).

Marine waters, beaches, barren lands, caves, and rangelands are the non-dominant classes in the Atlantic/Gulf coast physiogeographic region. Marine waters include nearshore and offshore waters of the Gulf of Mexico and the Atlantic Ocean. The Gulf of Mexico has a surface temperature gradient ranging from 67 ºF at the United States coastline, to 83 ºF near the Caribbean Sea. The Atlantic Ocean has a much wider range of temperatures, ranging from 79 ºF in the south to 45 degrees along the northern United States coast (NOAA, 2013c). Bottlenose dolphins, loggerhead sea turtles, and long-tailed duck are representative of the wildlife in nearshore waters. Small marine fauna, such as ghost shrimp and coquina clams, occur in the intertidal zone, as do gulls and other terrestrial predators (Georgia Sea Grant, 2015). Offshore waters support Fraser's dolphins, sperm whales, blue whales, and leatherback sea turtles (NOAA Fisheries, 2012a) (New Jersey Department of Environmental Protection, 2008).

Beaches in this region are primarily sand and are found along the coasts of the Atlantic Ocean and Gulf of Mexico, as well as on barrier islands. Beaches are very dynamic areas due to the strong influence of wind and wave erosion, particularly during strong storms. Onshore wind action often creates sand dunes as the sand is blown landward. Sand dunes support plants such as sea oats, marsh hay cordgrass, and morning glory (Williams, 2007). Intertidal and berm zones, both very harsh environments that generally do not support vegetation, are found between the sand dunes and the sea.

Barren lands occur in this region as rocky barrens on the coastline of New England, above the intertidal rocky shore. These areas are subjected to the harsh conditions of wind, surf, and salt spray, and are primarily bedrock. Vegetation is sparse, but species such as yarrow, quack grass, red fescue, seaside goldenrod, and narrow-leaved peppergrass grow out of the crevices in the rocks (New Hampshire Division of Forests and Lands, 2016). Many species of waterfowl, shorebirds, and seabirds use coastal islands and rocky shores for nesting and foraging, and are found in these rocky barren lands (New Hampshire Fish and Game Department, 2015).

Caves in the Atlantic/Gulf Coast physiogeographic region occur in limestone/karst topographies (Florida Park Service, 2015). Some wildlife species, such as cave crickets, use caves temporarily for shelter during the day before foraging for food at night. Other species have evolved to live entirely within the unique cave environment, such as the Dougherty Plain Cave crayfish (Niemiller, Fenolio, & Zigler, 2012). Examples of other species that inhabit caves include cave cobweb spiders, gray-foot lancetooth snail, Alabama cave shrimp, and Texas blind salamander (Reeves, 2001). Vegetation is only present near cave entrances in areas exposed to sunlight.

Rangelands in the Atlantic/Gulf Coast physiogeographic region typically consist of grasslands and meadows vegetated with grasses such as little bluestem, sawgrass, Indian grass, and switchgrass, and wildflowers such as black-eyed Susan, aster, and goldenrod. These rangelands support species such as meadowlark, bobolink, monarch butterflies, meadow fritillary, meadow vole, and grasshoppers.

3.7.3.2.6 Arid West/Southwest Physiogeographic Region

Rangelands dominate this physiogeographic region, and support a variety of vegetation types; low-growing shrubs and grasses are the most prevalent. Dominant grasses include blue-stemmed, three awn, galleta, and muhly grass. In the grassland areas, representative wildlife species include quail, pigeon, dove, hare, jackrabbit, coyote, gray fox, mule deer, white-tailed deer, and pronghorn antelope. In the shrub rangeland, flora such as sagebrush and mesquite are common, and Saguaro, hedgehog, and prickly pear cactus are also present. Jackrabbit, cottontail rabbit, ground squirrel, kangaroo rat, and several species of mice and bats are the most common mammals. Other representative wildlife species include sagebrush lizard, black-throated sparrow, golden eagle, mule deer, pronghorn antelope, coyote, bobcat, badger, feral burros, and feral horses.

Wetlands, fresh waters, barren lands, caves, forest lands, and agricultural lands are the non-dominant classes of this physiogeographic region. Wetlands are rare in the arid west/southwest. The most common wetlands are riverine; these wetlands receive water from overbank or side-channel flow from nearby streams. Notably, the Colorado River, Rio Grande, Snake River, and their tributaries support areas of riverine wetlands. Playas, fens, seeps, springs, and marshes are also present (New Mexico Environment Department, 2012). Salinity levels are variable in these wetlands. In more freshwater wetlands, there are flora species such as bulrush, cattail, field sedge, knot grass, and threesquare. In alkali-saline wetlands, the vegetation includes species like iodinebush, saltbush, sagebrush, and saltgrass. Wetland wildlife includes beavers, sandhill cranes, waterfowl, and frogs (New Mexico Department of Game and Fish, 2015).

Fresh waters in the arid west/southwest region include arroyos, rivers, and some lakes. Arroyos are ephemeral streams that are normally dry, but flow immediately following rain events or during periods of snowmelt (water from adjacent highlands often drains into deserts) (USGS, 1997b). Notable freshwater features in this region include the Colorado River, Rio Grande, and Snake River. Flora species found on freshwater banks in this region include seep willow, coyote willow, and alkali muhly (Natural Resources Conservation Service, 2008). Freshwater fish include razorback sucker, humpback chub, flannelmouth sucker, bluehead sucker, and speckled dace (NPS, 2016b).

The barren lands in this region are primarily arid, sandy expanses and areas of bare, exposed bedrock. Vegetation, when present, commonly consists of scattered ephedra, juniper, and shrubs and grasses that grow out of crevices in bedrock or near the foot of sand dunes. Wildlife species in arid west/southwest barren lands are well-suited to this unique and relatively harsh climate and include roadrunner, scorpion, kangaroo rat, various species of rattlesnake, horned lizard, gecko, Gila monster, elf owl, collard lizard, tarantula, and desert tortoise.

Caves in the arid west/southwest physiogeographic region are used by a variety of wildlife for different uses. Some species, such as certain spiders, salamanders, and millipedes, spend their entire lives within caves (Southwest Biological Science Center, 2015a). Many other species use the caves temporarily, usually as shelter from the extreme temperatures in this region. Other species shelter in caves during the day and then emerge to forage at night; examples include owls, porcupines, packrats, snakes, ringtail cats, and bats (Southwest Biological Science Center, 2015b). Vegetation is only present near cave entrances in areas exposed to sunlight.

Dry, evergreen forest lands are present in the higher elevations of the arid west/southwest region, vegetated with Ponderosa pine, Pinon pine, and Colorado fir. Oak and western junipers are common at the foot of the Sierras. Representative wildlife species of these forests include wolf, coyote, cougar, squirrels, rats, mice, hummingbirds, woodpeckers, and various reptiles and amphibians.

Agricultural lands make up only a fairly small percentage of the total land area in this physiogeographic region. In the northern areas, wheat, potatoes, sugar beets, hops, apples, and dry peas are grown. Cotton, grapefruit, lettuce, dates, and other vegetables are more common in the south. Overall, hay is the primary crop. Livestock grazing is also very common in this region, including cattle, goats, and sheep (U.S. Department of Agriculture, 2016). Waterfowl and other migratory birds use the crop or pasture land as a stop-over site during migration or as a food source (Pocewicz, Estes-Zumpf, Anderson, Copeland, & Keinath, 2013).

3.7.3.2.7 Great Plains Physiogeographic Region

Rangelands, forest lands, and agricultural lands dominate the Great Plains region. Rangelands include short-grass prairie, mixed-grass prairie, and tall-grass prairie, with the height of the grasses correlating with each area's moisture level. Common grasses of the Great Plains include blue grama, buffalograss, switchgrass, wheatgrass, and needlegrass. In drier areas of the Great Plains, sagebrush is also present. Wildlife species in these rangelands include those species that prefer open, flat land such as bison, pronghorn antelope, elk, mule deer, plains grizzly bear, ferruginous hawk, brown-headed cowbird, and plains wolf.

Forest lands dominate some areas of the Great Plains region, particularly in hilly areas and near and around the Upper Mississippi River and Missouri River systems. Forests in this region are typically deciduous species, dominated by species of oak and hickory. Representative wildlife in these forest lands include white-tailed deer, songbirds, various species of waterfowl, and monarch butterfly (USFWS, 2015f).

Large expanses of agricultural lands are present in the Great Plains region. Representative crops grown in the Great Plains include corn, barley, oats, wheat, and sorghum. Pastureland in this region primarily includes flat and expansive grazing areas for horses and cattle. Wildlife found on the agricultural lands of the Great Plains primarily include waterfowl and other birds that use agricultural lands as a stop-over site during migration or as a food source (Pocewicz, Estes-Zumpf, Anderson, Copeland, & Keinath, 2013).

Wetlands, fresh waters, barren lands, and caves are the non-dominant classes of the Great Plains region. Nonforested wetlands, such as vernal pools, wet meadows, and prairie wetlands, are scattered throughout the Great Plains region. Wetland plant species typically include prairie cordgrass, water plantain, sedges, rushes, arrowhead, buttonbush, and water lily (Navarrete-Tindall, 2009). These wetlands support mallard, northern pintail, and redhead ducks, whooping cranes, grebes, gulls, pheasants, muskrats, and deer (Dahl, Status and Trends of Prairie Wetlands in the United States 1997 to 2009, 2014).

The Great Plains region contains the majority of the Mississippi and Missouri River systems, which support freshwater and riparian areas of high biological importance, particularly to migratory birds. Flora species range from submergent to emergent, and include wild celery, water stargrass, white waterlily, wild rice, and arrowhead (Langrehr, 2000). Fauna species characteristic of freshwater systems in this region include freshwater mussels, river otters, muskrats, hundreds of species of fish, and birds that hunt in water, such great blue herons and bald eagles (NPS, 2016c).

Barren lands in this physiogeographic region occur intermixed with rangelands, particularly in the northwestern portion of the region (Vance & Luna, 2010) (Rolfsmeier & Steinauer, 2010). Known as the

Badlands, these areas are composed of dry, easily eroded soil that has been carved into rugged formations (Vance & Luna, 2010) (Rolfsmeier & Steinauer, 2010). Vegetation is very sparse, but includes saltbush, greasewood, wheatgrass, buckwheat, and threadleaf snakeweed. The Badlands provide habitat for pronghorn antelope, coyotes, shrews, prairie rattlesnakes, golden eagles, cliff swallows, rock wrens, and turkey vultures (Vance & Luna, 2010).

Caves in the Great Plains physiogeographic region occur in karst basins where groundwater has carved subterranean passages. Some of these cave systems are hundreds of miles long (NPS, 2015f). Terrestrial species use these caves as shelter, while other species have unique adaptations for permanent cave habitation, including the loss of pigmentation and eyes (Edmonson County, 2007). Representative fauna of the Great Plains caves include little brown bats, big brown bats, packrats, and localized species such as the Kentucky cave shrimp (Edmonson County, 2007) (NPS, 2015g) (NPS, 2015f). Vegetation is only present near cave entrances in areas exposed to sunlight.

3.7.3.2.8 Great Lakes Physiogeographic Region

Wetlands, fresh waters, forest lands, and agricultural lands dominate the Great Lakes region. Nonforested wetlands, or marshes, are common near and along the Great Lakes' shores, and support floating and sub-emergent aquatic plants, such as duckweed, cattails, bulrushes, and water lilies. Representative wildlife in these wetlands include great blue heron, wood duck, trumpeter swan, eastern fox snake, mud turtle, and bullfrog (NOAA, 2015c).

The Great Lakes are the largest bodies of fresh water in the United States and occupy a significant portion of the Great Lakes physiogeographic region. Flora of the Great Lakes includes several species of sub-emergent and emergent aquatic plants and algae, such as chara, stonewart, and pondweed. Representative wildlife include fish such as the walleye, northern pike, brook trout, and muskellunge, and semiaquatic mammals, such as the beaver and river otter (NOAA, 2015c).

The forested lands of this region primarily support closed stands of conifers, primarily consisting of white and black spruce, jack pine, balsam fir, and tamarack. Towards the southern portion of this region, deciduous stands of white birch, trembling aspen, sugar maple, beech, and various species of oak are present. Below the tree canopy, a range of plant communities is dominated by lichens, shrubs, and forbs. Characteristic wildlife include woodland caribou, white-tailed deer, black bear, raccoon, marten, fisher, striped skunk, lynx, bobcat, eastern chipmunk, boreal owl, great horned owl, blue jay, and evening grosbeak.

Agricultural lands of the Great Lakes region primarily produce corn, soybeans, and hay. Specialty crops, such as cherry orchards in the Lower Peninsula of Michigan, are also grown here. Dairy cows and cattle are the primary livestock of this physiogeographic region (NOAA, 2015c). Wildlife found on the agricultural lands of the Great Lakes region include waterfowl and other birds that use the crop or pasture land as a stop-over site during migration or as a food source (Pocewicz, Estes-Zumpf, Anderson, Copeland, & Keinath, 2013).

Beaches, barren lands, caves, rangelands are the non-dominant classifications in the Great Lakes region. Beaches are primarily located along the shores of the Great Lakes, and mostly consist of sand and gravel. Typically, these beaches are linear and narrow, between 1-2 miles long (Albert, Natural Community

Abstract for Sand and Gravel Beach, 2010a) and are shaped by the defining forces of wind, waves, and winter ice. Due to the high degree of disturbance and instability, vegetation is sparse. However, where vegetation does establish itself, coastal dunes form. Some beaches along the Great Lakes consist of cobble shore and bedrock. Beach plants in this region include beach pea, Baltic rush, silverweed, and sea rocket. Representative fauna species include raccoons, river otters, piping plovers, common terns, and Blanding's turtles (Albert, Natural Community Abstract for Sand and Gravel Beach, 2010a).

Barren lands in this region occur on cliff faces, where bare rock is vertical or nearly vertical. These areas do not support vascular plant growth except in cracks and crevices, but lichens, liverworts, and mosses are abundant. Representative fauna here include bats, swallows, deer mice, raccoons, snakes, and bald eagles (Kost, et al., Limestone Cliff, 2014b). There are also areas of open sand along the coastal dunes in the Great Lakes region. These "blowouts" are further inland than the beaches where the dunes are typically stabilized by grasses and shrubs, but have been destabilized by wind (Albert, Natural Communities Abstract for Open Dunes, 2010b).

Caves in the Great Lakes region occur in areas with karst topography, formed by the dissolution of dolomite and limestone. Caves act as drainage systems and thus often have water running through them (Kost, et al., Cave, 2014a). Some wildlife species use caves as a temporary habitat, while other species live there permanently. Representative fauna species of caves in the Great Lakes region include the little brown bat, eastern pipistrelle, raccoon, cave cricket, and funnel-web spider. Vegetation is only present near cave entrances in areas exposed to sunlight (Bureau of Natural Heritage Conservation, 2014).

Rangelands in this region consist of dry and moderately dry prairies, often located in flat areas with sandy soils (Kost, Dry Sand Prairie, 2010). Vegetation ranges from short and patchy to medium height and density, depending on local moisture levels (Kost, Dry Sand Prairie, 2010) (Kost & Slaughter, Mesic Sand Prairie, 2009). Representative rangeland flora species include big bluestem, little bluestem, and Indian grasses, as well as Pennsylvania sedge (Kost & Slaughter, Mesic Sand Prairie, 2009). Rangelands are often bordered by smaller areas of oak barrens and pine barrens, where canopy cover ranges from 5 to 60 percent (Cohen, 2010). Representative rangeland fauna of this region include sparrows, owls, prairie voles, box turtles, and ratsnakes (Kost & Slaughter, Mesic Sand Prairie, 2009).

3.7.3.3 Nationwide Representative Threats to Biological Resources

The following discussion describes common threats to biological resources that occur among the different identified physiogeographic regions nationwide, including human development, invasive species, parasites/diseases, predation, hunting/fishing/overexploitation, and climate change. These threats apply in varying degrees to all biological resources described in this resource section.

3.7.3.3.1 Human Activities

Floodplain development is not an action under the NFIP, and FEMA does not have any appreciable influence on the rate or quantity of development in floodplains. However, human development can have significant effects on biological resources. The general effects of human activities include: (1) habitat loss, fragmentation, degradation, and disturbance; (2) degradation of water quality; (3) changes to hydrology, erosion, and sediment transport; (4) degradation or removal of movement and migration corridors; (5) mining; (6) oil and gas development; (7) agriculture; and (8) wildfires (EPA, 1993) (McGarigal, Cushman, & Regan, 2005).

Habitat loss, fragmentation, degradation, and disturbance are the result of incremental conversion of natural lands to agricultural, residential, commercial, or industrial uses, including oil, gas, and mineral extraction, and timber harvesting. In addition to direct habitat loss within the construction footprint, degradation to surrounding natural lands may occur from erosion or through the introduction of non-native plants and animals. Habitat fragmentation decreases the amount of core or interior habitats, and increases the amount of edge habitat, which often lacks the transition zones found in natural habitat edges. This reduces overall habitat functionality (EPA, 1993) (McGarigal, Cushman, & Regan, 2005) and can increase predation and the risk of parasitism by other species (USFWS, 1999).

Changes to water quality resulting from development include increases in turbidity from erosion; increases in water temperature from removal of overhanging vegetation; and both non-point source pollution (contaminants from roadways, parking lots, and lawns) and point source pollution (wastewater treatment plants, industrial activities, etc.) (North Carolina State University, 1995). Pollutants are generated from a variety of sources, including agriculture, mining, petroleum exploration, and chemical manufacturing.

Development may also cause changes to hydrology, erosion, and sediment transport. For instance, channelization of waterways and installation of hardened banks can alter flows, direct flood energy to other areas, and affect sediment transport; the resulting changes in substrates, flow rates, and depths may alter aquatic habitats (North Carolina State University, 1995).

The degradation or removal of migration corridors occurs as a synergy of the habitat changes described above. As habitat and vegetative cover are fragmented by development, movement becomes increasingly difficult and species are exposed to greater risks, such as vehicle collisions and predation (McGarigal, Cushman, & Regan, 2005). Fencing, retaining walls, and curbs may constitute barriers to some terrestrial animals. For aquatic animals, the installation of dams for flood control or water diversions may prevent the upstream movement of fish and other aquatic organisms. Plant populations may also be affected because intervening areas of unsuitable habitat may prevent populations from spreading or re-colonizing areas from which they have been extirpated (EPA, 1993).

Mining and quarrying activities can destroy habitat; leaching of exposed rocks or chemical used during mining can contaminate waterways. Mining for gold and uranium has been proven to cause water quality impacts. Coal and molybdenum mining may cause impacts to air and water quality (Colorado Deparment of Natural Resources, 2015).

Oil and gas development involves the exploration and production of natural resources. These activities require infrastructure such as pipelines and roads. Conversion of habitat and habitat avoidance are concerns for terrestrial wildlife, as is noise from drilling and operations. Water used during drilling or released accidentally may contaminate nearby waters impacting fish, insects, shorebirds, amphibians, and other species (Colorado Deparment of Natural Resources, 2015). Oil spills can be detrimental to wildlife, particularly aquatic wildlife. Oil itself is toxic to many aquatic species, via the ingestion, inhalation, or external exposure. In addition, oil on feathers and fur on mammals and birds may reduce body temperatures and can smother other small species, such as invertebrates or fish (NOAA, 2016b).

The impacts of croplands and livestock farming are dependent on the how the practices are undertaken and where. Potential impacts from livestock farming and croplands can include chemical contamination, nutrient runoff, non-point source pollution, and pesticides (USFWS, 2013b). Livestock farming and ranching practices can change the characterization of an area with reduced native species or habitat suitability for plant and animals (Colorado Deparment of Natural Resources, 2015).

Wildfires can control the density of trees and shrubs in a forest and allow for regeneration. Without natural wildfires, understory fuels may buildup and trees become denser thereby allowing wildfires to spread more readily. Sterilization of soils can result from extremely high fire temperatures, curtailing the ability for plant regrowth. Wildfires can also cause erosion, sedimentation, and degrade water quality that could direct affect terrestrial and aquatic species and their habitats (Colorado Deparment of Natural Resources, 2015).

3.7.3.3.2 Invasive Species

An invasive species is a species introduced to an ecosystem to which it is not native and which is likely to cause environmental or economic harm or harm to human health (Executive Order 13112, 1999). Invasive species can disturb natural communities and ecosystems by changing the composition and quality of habitat; reducing stream flows; degrading water quality and changing water temperatures; displacing and/or causing major alterations of native plant communities; competing for food, water, cover, or breeding sites; disrupting the food chain; increasing soil erosion; increasing wildfire potential, and preying directly upon species (USFWS, 2012c). Invasive species can harm and prey on native species, leading to declines in native populations (USFWS, 2012c). Cross-breeding between native and invasive species can also lead to genetic concerns; for example, recent evidence suggests the endangered Hawaiian duck breeding with invasive Mallard ducks may lead to the genetic extinction of the Hawaiian (USGS - University of California Davis, 2007). Invasive species are often part of the reason native species are listed as threatened (USFWS, 2012c). Invasive species represent the second leading cause of species extinction and loss of biodiversity in aquatic environments worldwide (EPA, 2015g).

Invasive species grow and reproduce quickly, and spread aggressively. Exotic invasives can rapidly colonize new areas, as they are no longer controlled by their native predators or diseases (University of California Integrated Pest Management Program, 2015). Competition with invasives can be especially damaging to native wildlife if diet or cover requirements are similar and the habitat is at carrying capacity. In this situation, native populations may decline if they are unable to adapt to the stress of habitat depletion caused by the introduced species. For example, in response to a reduced food supply, exotic invasives may be able to shift to foods that are less preferred but more available. If native species cannot do the same, the native species will not compete well for available resources (Traweek & Welch, 1992).

3.7.3.3.3 Parasites/Diseases

Parasites and diseases have become increasingly common and can pose significant risks to natural populations. Diseases, especially in small or fragmented populations, may compromise populations of flora and fauna by killing individuals more rapidly than they can reproduce, thus suppressing population growth rates (Pedersen et al., 2007). Introduced exotic species may carry harmful diseases or parasites to which native species may not have immunity (Traweek & Welch, 1992). However, native wildlife also carry parasites that adversely affect other native species.

3.7.3.3.4 Predation

Predation affects many threatened and endangered species, for which the loss of a very few individuals may have a greater impact due to smaller populations. In addition to native predators, exotic, native, domesticated, and feral species often increase predation pressure on native species.

3.7.3.3.5 Hunting/Fishing/Overexploitation

Hunting, fishing, and overexploitation of species have occurred for centuries. Humans depend on plants and wildlife for a variety of necessities, such as food, shelter, clothing, medicine, and other needs. Illegal hunting (or historical legal overhunting) for sport or to protect livestock continues to threaten large carnivores (NatureServe, 2009) (Northern Continental Divide Ecosystem, 2013). Commercial and recreational fishing can result in entrapment or entanglement of marine mammals and sea turtles in fishing gear (USFWS, 2001). Overexploitation occurs when humans hunt or fish to the extent that species population levels become unsustainable. Humans hunted the passenger pigeon to extinction by the early 1900s; overhunting nearly caused the extinction of several whale species and the American bison until the enactment of protective legislation (USFWS Pacific Southwest Region, 2013) (Braham, 1984) (USFWS Witchita Mountains Wildlife Refuge, 2014).

Large mammal species are frequently hunted for their fur, food, sport, and for their antlers, horns, or tusks. Birds are collected or hunted for sport, food, and as pets (particularly parrots and songbirds). Reptiles are collected or harvested for their skins or shells, eggs, food, and as pets (such as the box turtle). Reptile skins (e.g., python and crocodile) are prized and highly valued for trade. Overfishing concerns for marine invertebrates can arise when market prices are sufficiently high to encourage illegal fishing or when harvest by the fishing industry is not easily monitored or controlled (Jamieson, 1993).

3.7.3.3.6 Climate Change and Extreme Weather Events

Extreme weather events include tropical storms, heavy precipitation, flooding, tsunamis, volcanic eruptions, landslides, earthquakes, wildland fires, heat waves, and droughts, all of which may lead to direct mortality or intensify existing stressors on biological resources (U.S. Climate Change Science Program, 2008). Hurricanes and severe flooding can scour areas removing plants and topsoil, and may introduce stored or stockpiled contaminants into waterways when developed areas are flooded (North Carolina State University, 1995). Although sudden extreme events capture the public's attention and can have serious consequences on species, the slower, more long-term extreme weather related to climate change, such as drought, are equally threatening to biological resources (USGS, 2007b).

Climate change can potentially cause abrupt changes to habitat and ecosystems, and may be a threat to many species. Notably, climate change is affecting the migration of songbirds; breeding birds' arrival dates are changing, often occurring before the necessary food supply is available. Climate change has exacerbated wildfires, insect outbreaks, pathogens, coral bleaching, disease outbreaks, and tree mortality. Higher water temperatures resulting from climate change may impact cool water fish, and rising sea levels affect many fish and wildlife habitats (USFWS, 2012d). Climate change effects also include warmer air and ocean temperatures, more high-intensity rainfall events, and heat waves that are more frequent. Warming temperatures also cause increases in ozone levels that can damage vegetation (EPA, 2012f).

3.7.3.4 Migratory Birds/Flyways

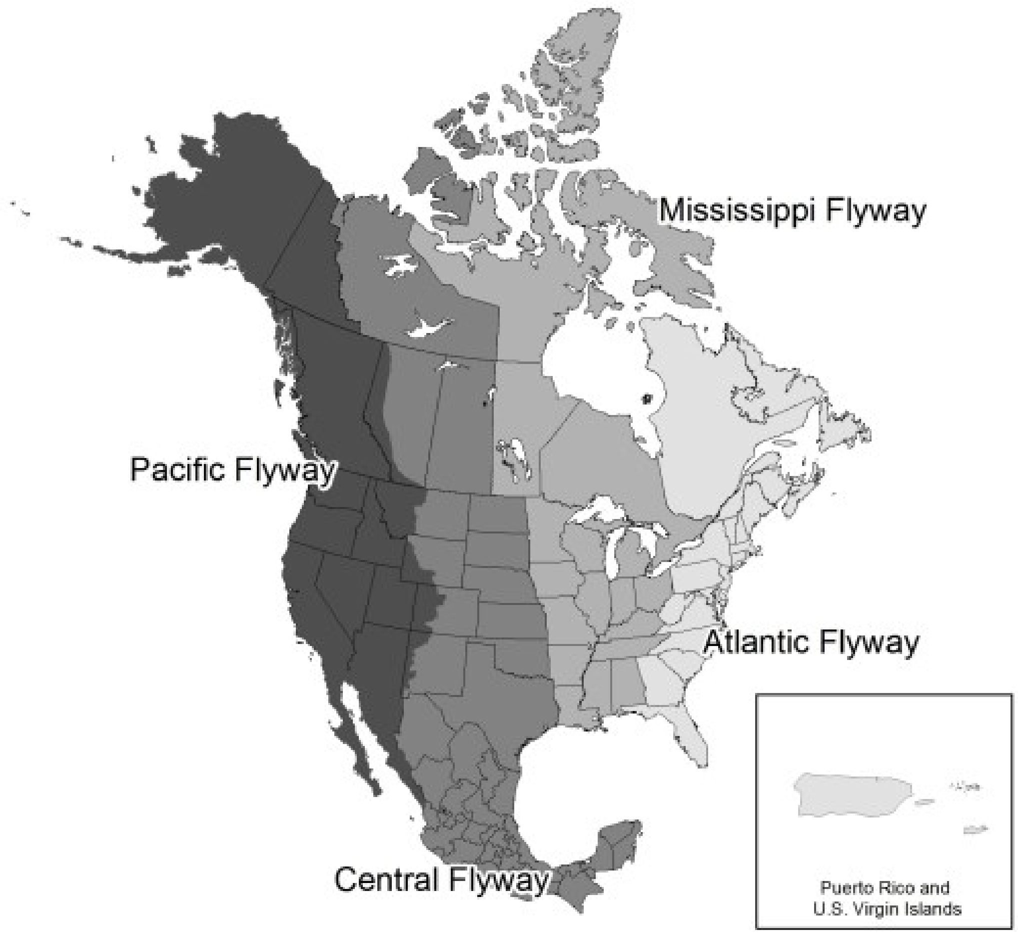
Under the MBTA, signed in 1918, and amended in 1936, 1974, and 1978, it is illegal to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of a migratory bird, except under the terms of a valid permit issued pursuant to Federal regulations. A list of all migratory birds protected under the MBTA can be found at 50 C.F.R. § 10.13 and online via the USFWS migratory bird program list (USFWS, 2013c).

Throughout the progression of the seasons, many species of birds undergo a natural process, referred to as migration, of relocating from one region to another at regular times, often over long distances. These birds move from areas of low or decreasing resources to areas of high or increasing resources (primarily food sources and nesting locations) which are different for each species. More than half of the 650 bird species of North American breeding birds are migratory. Migratory birds that nest in North America tend to migrate northward in the spring to take advantage of seasonally abundant food and nesting locations; as winter approaches and the availability of food drops, the birds move south again. (Cornell Lab of Ornithology, 2016). Migratory birds would be expected to utilize all of the modified Anderson classifications within the Action Area, with the exception of caves and perennial snow and ice.

The most common migration pattern is birds flying north in the spring to breed in the temperate or Arctic summer and returning in the fall to wintering grounds in warmer southern regions. However, each species, or group of species, migrates at a particular time of the year, and distances vary greatly. Migratory birds can be categorized based on their migration patterns. *Short-distance migrants* are typically permanent residents in most of their range; however, these species tend to migrate from the edges of their range, across elevations within their range, or in certain pockets of their range. These short-distance migrations are usually in response to harsh weather conditions that lead to reduced resource availability. In the Mountains region, this includes elevation migration in response to seasonal weather and resource availability. *Medium-distance migrants* tend to exhibit a variety of irregular patterns of north/south migration, but remain in North America. *Long-distance migrants* undertake migratory journeys that can take weeks to complete and cover thousands of miles across multiple countries. (Cornell Lab of Ornithology, 2016)

Flyways are broad flight paths used during migration; these flyways can vary greatly in their complexity, reach, and breadth. There are four major flyways in North America, which are based primarily on routes the birds follow as they migrate between nesting and wintering areas: the Atlantic, Mississippi, Central, and Pacific (see Figure 3-18). These flyways are vital to the survival of many migratory bird species, serving as important travel corridors connecting breeding grounds to wintering grounds. The flyways extend across a variety of habitats that serve as resting areas where migrants can feed and prepare for the remaining travel ahead, and as breeding grounds for many species. (Flyways.us, 2008)

Each flyway has a Council, consisting of representatives from each State, provincial, and territorial agency within that flyway to facilitate management of migratory birds and their habitats (USFWS Migratory Bird Program, 2015).



Source: (USFWS Migratory Bird Program, 2015)

Figure 3-18: Migratory Bird Flyways in North America

3.7.3.4.1 Atlantic Flyway

Stretching from the Arctic tundra of Baffin Island in northern Canada to the subtropical islands of the Caribbean, the Atlantic Flyway spans more than 3,000 miles (Ducks Unlimited, 2016). The Atlantic Flyway includes a variety of productive ecosystems, including forests, beaches, and wetlands, and supports more than 500 bird species and millions of individual birds (Audubon Society, 2011). Within the United States, this easternmost flyway covers most of the Atlantic/Gulf Coast region and all of the Appalachian Mountains region and includes the States of Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia, Puerto Rico, and USVI, as well as the Canadian provinces of Newfoundland, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec (Flyways.us, 2008).

3.7.3.4.2 Mississippi Flyway

More than 2,300 miles long with a watershed of more than 1.5 million square miles, the Mississippi River is North America's greatest river, and the core of the most heavily used migration corridor for migratory birds (Ducks Unlimited, 2016). Nearly half of North America's bird species, and about 40 percent of its waterfowl, use the Mississippi Flyway (Audubon Society, 2011). Extending from the Great Lakes region through the eastern portion of the Great Plains region and to the Gulf portion of the Atlantic/Gulf Coast region, this flyway includes Alabama, Arkansas, Indiana, Illinois, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Ohio, Tennessee, Wisconsin, and the Canadian provinces of Saskatchewan, Manitoba, and Ontario (Flyways.us, 2008).

3.7.3.4.3 Central Flyway

The Central Flyway is massive, covering more than 1 million square miles across the interior of North America (Ducks Unlimited, 2016) and extending from Canada's boreal forest and parklands, across the Great Plains region, and south to the Gulf portion of the Atlantic/Gulf Coast region. This flyway includes Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Wyoming, and the Canadian provinces of Alberta and Saskatchewan, and the Northwest Territories (Flyways.us, 2008). Approximately 400 species of birds use the Central flyway of North America (Johnsgard, 2015).

3.7.3.4.4 Pacific Flyway

The Pacific Flyway stretches 4,000 miles north-to-south and 1,000 miles east-to-west, encompassing a variety of habitats (Ducks Unlimited, 2016). Extending from the arctic plains and Pacific to the West Coast of Mexico and from the Rocky Mountains to the Pacific Ocean, this flyway encompasses the most varied migratory bird and waterfowl habitats in North America (Ducks Unlimited, 2016). Hundreds of species and at least one billion birds migrate along the Pacific Flyway each year (Audubon Society, 2011). This westernmost flyway traverses the Mountain Region, Arid West/Southwest region, and the entire Pacific Coast region, and includes Alaska, Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington; those portions of Colorado, Montana, New Mexico, and Wyoming west of the Continental Divide; and the Canadian provinces of British Columbia and Alberta, and the Yukon and Northwest Territories (Flyways.us, 2008).

3.7.3.4.5 Oceanic Migrations

The Hawaiian Islands, as well as Guam and the Marshall Islands, support a variety of migratory shorebirds, seabirds, and waterfowl. These birds do not utilize the North American flyways, but do make migratory movements around the Pacific Ocean. Some of these sea birds make short distance migrations within island chains, while others spend the majority of time travelling the open ocean in search of food, only returning to land to nest. Also included in this group are birds that migrate across the Pacific from Alaska to Japan, China, and Southeast Asia. (Asia-Pacific Migratory Waterbird Conservation Committee, 2001)

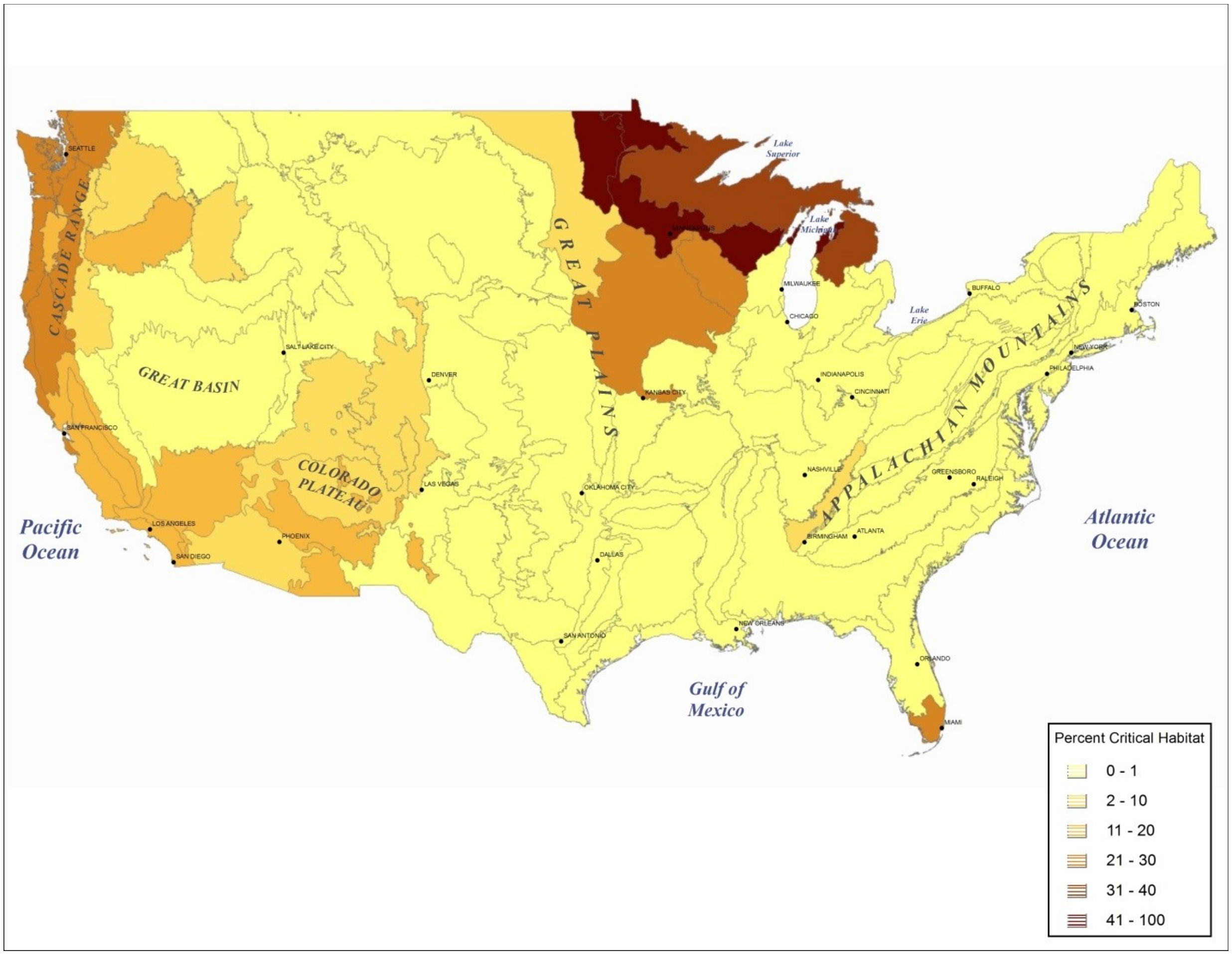
3.7.3.5 Threatened and Endangered Species

Signed into law in 1973, the ESA is designed to protect species designated by the ESA as threatened and endangered and the ecosystems upon which they depend. USFWS has jurisdiction over terrestrial and freshwater organisms, and NOAA Fisheries has jurisdiction over marine wildlife and anadromous fish. Under the ESA, an endangered species is defined as one which is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as one which is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.

Per 40 C.F.R. § 1502.25(a), preparation of an EIS is to be integrated with environmental impact analyses required under separate laws (including the ESA) to the fullest extent possible. FEMA prepared a BE pursuant to Section 7 of the ESA to evaluate the potential effects of the Proposed Action on ESA-listed species and designated critical habitats within floodplains across the nation (Appendix C) (FEMA, 2015b). Detailed descriptions of threatened and endangered species can be found in the BE (Appendix C). Methodologies used in the BE, as well as broad species descriptions, are provided below. [Note: The BE Action Area for ESA-listed species and designated critical habitats is the same as the Action Area described in this NPEIS.]

As of December of 2014 (when data were collected for the BE), there were 1,537 species (649 animals and 888 plants) in the United States listed as threatened or endangered (FEMA, 2015b). [Note: ESA-listed species designations are subject to change. The most current information is available from the USFWS Environmental Conservation Online System website (USFWS, Undated(b)).] USFWS and the NOAA Fisheries share responsibility for implementing the ESA: USFWS is responsible for land-based species and all non-marine species; NOAA Fisheries is responsible for marine species and anadromous fish.

Designated critical habitat is a specific geographic area with features essential to the conservation or recovery of an ESA-listed species. Designated critical habitat may include areas that are not currently occupied by an ESA-listed species but that will be needed for its recovery. Figure 3-19 shows the percentages of critical habitat present throughout the contiguous 48 states. Information on designated critical habitat is not available for areas outside the contiguous United States. (USFWS, 2013d)



Source: (ESRI, 2015)

Figure 3-19: Percent Designated Critical Habitat in the Contiguous United States

3.7.3.5.1 Habitat Classifications that Support ESA-Listed Species

Habitats that met the physical and biological needs for at least one ESA species were considered likely to support ESA species (Figure 3-20). To determine whether a habitat classification is likely to support ESA species, FEMA first identified all species listed or proposed for listing under the ESA at the time the BE was prepared (Government Publishing Office, 2015a) (Government Publishing Office, 2015b) (NOAA Fisheries, 2015b) (USFWS, 2015g). Information on each species' physical and biological needs was then obtained from the Services' websites—the USFWS Environmental Conservation Online System and Information, Planning, and Conservation System websites, and the NOAA Fisheries Office of Protected Resources website. Other sources of information included recovery plans and critical habitat designations for ESA-listed species, and other governmental, academic, and private sources. A team of biologists and ecologists reviewed the information and assigned each species to a primary habitat, defined here as the habitat classification that meets most or all of a species' physical and biological needs for most or all of its life cycle.

Based on this review of ESA-listed species and their physical and biological needs, 9 of the 12 habitat classifications described in Section 3.7.3.2, General Flora and Fauna were determined likely to also support ESA-listed species and designated critical habitats: wetlands, fresh waters, marine waters, beaches, barren lands, caves, rangelands, forest lands, and perennial snow or ice. Three habitat classifications were determined not likely to support ESA-listed species and designated critical habitats: urban/built-up lands, agricultural lands, and tundra.

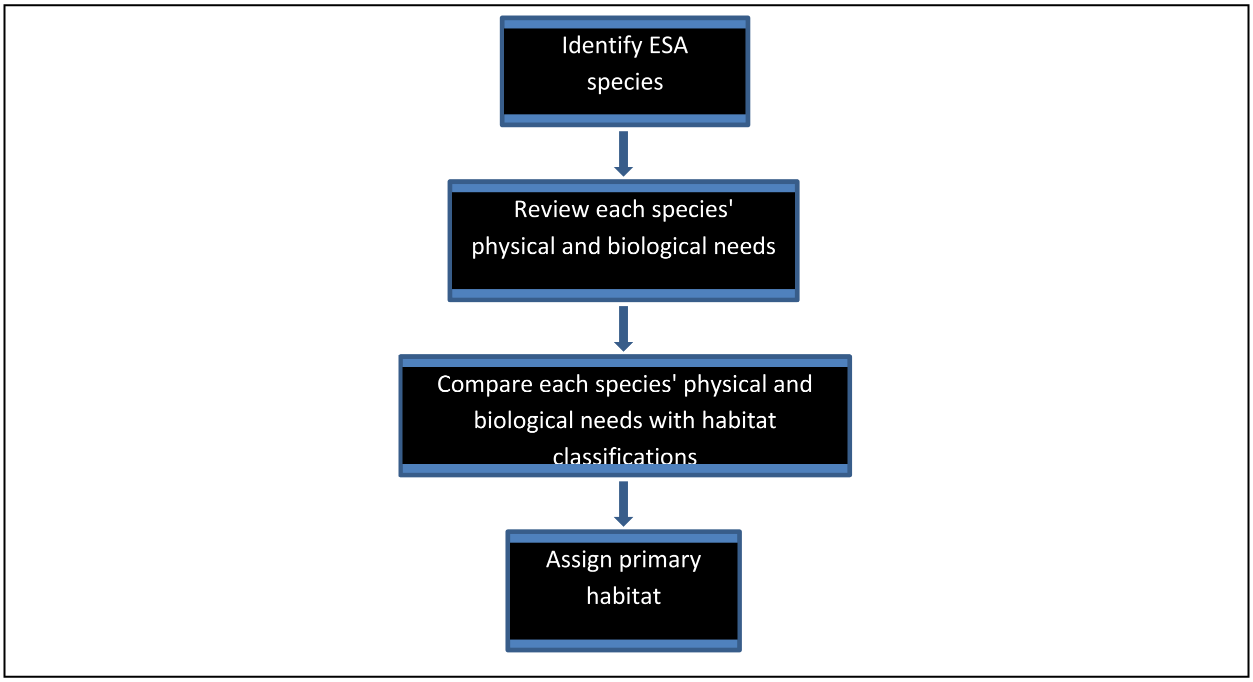


Figure 3-20. ESA Habitat Classification Process

It was necessary to categorize species by primary habitats used, even though a species may use other habitats at various times. For example, endangered Mississippi sandhill cranes are assigned to the nonforested wetlands habitat in this document. These birds may sometimes forage in agricultural fields, but a review of the literature supports a determination that those areas are not considered the primary habitat for this species. Also, because critical habitats are species-specific and this document assesses broad species groups rather than individual species, designated and proposed critical habitats are considered a subset of the habitats that support ESA-listed species and are not addressed individually.

3.7.3.5.2 Species Groups

Listed and proposed species were sorted into seven broad species groups using the high-level classifications from both USFWS and NOAA Fisheries species listings: mammals, birds, reptiles, amphibians, fish, invertebrates, and plants. These groups were further divided into sub-groups based on primary habitats (modified Anderson classifications) and are described in more detail in the BE (Appendix C) (FEMA, 2015b).

Mammals are warm-blooded vertebrates of the class Mammalia. Distinguishing characteristics of mammal species include giving birth to live young, mammary glands on females, and the presence of hair at some stage of development. Because mammalian young are dependent on mothers for nourishment, they learn to copy their elders; thus, mammals have great behavioral adaptability. Because they are warm-blooded, mammals also have the ability to physically adapt to a wide range of climates and conditions. This species group has eight sub-groups: wetland mammals, nearshore marine mammals, offshore marine mammals, beach mammals, barren land mammals, rangeland mammals, forest land mammals, and perennial snow or ice mammals. Almost all mammal species are under the jurisdiction of USFWS; marine mammals, except for sea otters and manatees, are regulated by NOAA Fisheries (USFWS, 1984).

<u>Birds</u> are warm-blooded vertebrates of the class Aves, which bear young in a hard-shelled egg and have a body covered with feathers, forelimbs modified into wings, scaly legs, a beak, and no teeth. This species group is entirely under the jurisdiction of USFWS and includes both migratory and non-migratory birds. There are eight sub-groups of birds: forested wetland birds, nonforested wetland birds, freshwater birds, nearshore marine birds, offshore marine birds, beach birds, rangeland birds, and forest land birds.

<u>Reptiles</u> are any cold-blooded vertebrate of the class Reptilia, consisting of turtles, snakes, lizards, crocodilians, and amphisbaenians (worm lizards). Key features that separate this group from amphibians are the presence of scales and the dependence of all life stages on breathing air. This species group has five sub-groups: wetland reptiles, offshore marine reptiles, inland sandy areas reptiles, rangeland reptiles, and evergreen forest reptiles. All species are under the jurisdiction of USFWS, except for offshore marine reptiles (sea turtles), which are regulated by NOAA Fisheries.

<u>Amphibians</u> are cold-blooded vertebrates of the class Amphibia, comprising frogs, toads, newts, and salamanders. The four sub-groups of amphibians are wetland amphibians, freshwater amphibians, cave amphibians, and forest land amphibians. All threatened and endangered amphibians are under the jurisdiction of USFWS.

<u>Fish</u> are any of the various cold-blooded, aquatic vertebrates, having gills, fins, and typically an elongated body covered with scales. The four sub-groups of fish are freshwater resident fish, nearshore marine fish, anadromous fish, and cave fish. Freshwater resident fish and cave fish are under the jurisdiction of the USFWS; NOAA Fisheries has jurisdiction over nearshore marine fish and anadromous fish (fish that migrate from saltwater into fresh water to spawn or fish that remain in fresh water but migrate upstream to spawn).

<u>Invertebrates</u> account for more than 95 percent of all animals on earth, and are found in almost every terrestrial and aquatic environment. Invertebrates include any living animal without a backbone; animals that make up this large species group include insects, worms, clams, snails, crayfish, and shrimp. Invertebrates are found in a wide variety of habitats represented by nine sub-groups: forested wetland invertebrates (snails, insects, and arachnids); nonforested wetland invertebrates (snails and insects); fresh water invertebrates (mussels, snails, crustaceans, and insects); nearshore marine invertebrates (corals and snails); beach invertebrates (snails and insects); barren land invertebrates (snails, crustaceans, insects, and arachnids); cave invertebrates (insects and arachnids); rangeland invertebrates (insects); and forest land invertebrates (snails, insects, and arachnids). All species are under the jurisdiction of USFWS, except for the marine invertebrates (snails and corals), which are regulated by NOAA Fisheries.

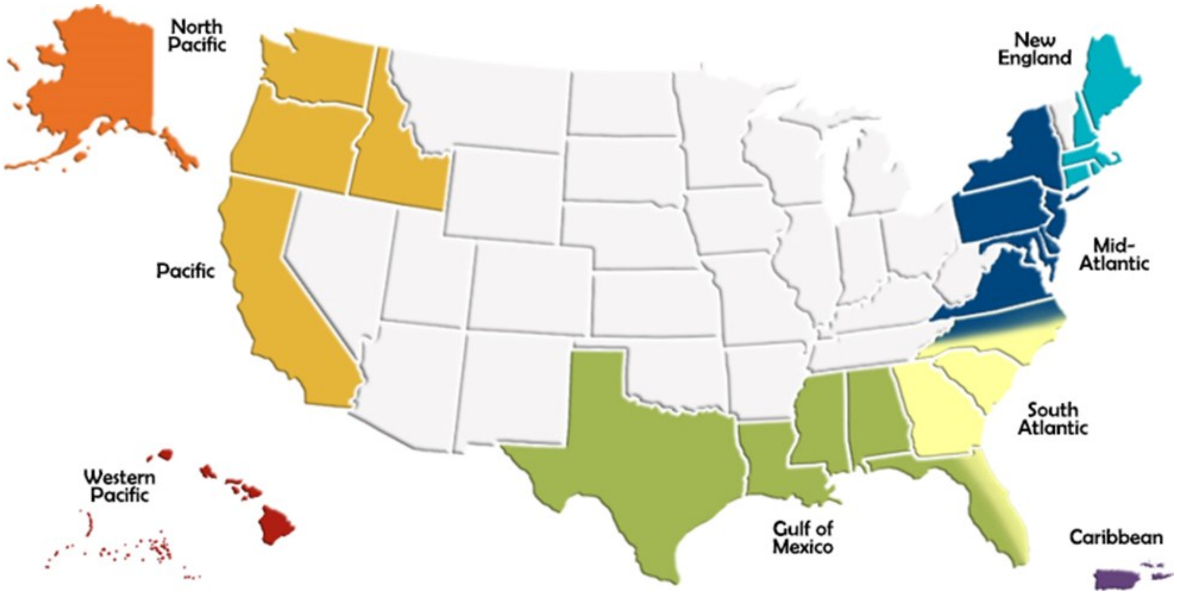
<u>Plants</u> include any member of the kingdom Plantae, comprising multicellular organisms that typically produce their own food from inorganic matter through the process of photosynthesis and that have

relatively rigid cell walls containing cellulose. The plant species group includes a wide array of taxa, including trees, shrubs, grasses, ferns, lichen, and flowering plants. While all plant species are capable of reproducing sexually, some species also can reproduce clonally through fragmentation, the production of spores, or through specialized structures such as rhizomes or bulbs. In conifers and flowering plants, sexual reproduction occurs through pollination, which can occur either via wind-borne pollen or with the assistance of pollinators, such as bees and other insects, hummingbirds, and bats. Plants disperse their seeds through a variety of means, including gravity, wind, animals (both through ingestion or external attachment), and water. The distribution of individual species within the sub-groups is defined by climate, soil types, elevation, aspect, and other physical parameters. Many of the species in this group are endemic to small and geographically isolated areas. Plants are divided into eight sub-groups: forested wetland plants, nonforested wetland plants, freshwater plants, nearshore marine plants, beach plants, inland sandy area plants, rangeland plants, and forest land plants. USFWS has jurisdiction over all threatened and endangered plants, with the exception of one marine species (Johnson's seagrass) under the jurisdiction of NOAA Fisheries.

3.7.3.6 Essential Fish Habitat

Productive commercial and recreational fisheries in the United States are linked to healthy marine habitats that in turn support local fishing communities and many industries nation-wide. Under the MSA (NOAA Fisheries, 2007), as amended by the Sustainable Fisheries Act of 1996 (P. Law 104-267), Congress mandated the identification of habitats essential to managed species and measures to conserve and enhance these habitats. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity… 'Waters' includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle" (NOAA Fisheries, 2004). NOAA Fisheries, the regional FMCs, and Federal and State agencies cooperate to protect, conserve, and enhance EFH.

Regional FMCs must prepare FMPs, which include the identification of EFH used by all life history stages of each managed species (NOAA Fisheries, 2007). NOAA Fisheries and the regional FMCs also identify Habitat Areas of Particular Concern (HAPC), which are areas within EFHs that are particularly important for the long-term productivity of populations of one or more managed species, or to be particularly vulnerable to degradation (NOAA Fisheries, 2015a). The eight regional FMCs are shown on Figure 3-21.



Source: (NOAA Fisheries, 2015a)

Figure 3-21: Regional Fishery Management Councils

EFH is designated by NOAA Fisheries and includes all types of aquatic habitats—wetlands, coral reefs, seagrasses, and rivers—where marine and anadromous fish spawn, breed, feed, or grow to maturity. EFH occurs in offshore waters, nearshore waters, estuaries, tidally influenced rivers, and freshwater areas. Designated EFH is present in many NFIP participating communities on the Atlantic, Gulf, and Pacific Coasts, as well as waterways supporting salmon in these communities.

EFH has been described for approximately 1,000 managed species to date (NOAA Fisheries, 2015a). These include groundfish, such as flounder; pelagic species, such as tuna and mackerel; anadromous fish, such as salmon; and shellfish, such as scallops. NOAA Fisheries and the FMCs have also identified more than 100 HAPCs.

Pursuant to Section 305(b)(2) of the MSA, a Federal agency must consult with NOAA Fisheries on all activities, or proposed activities, authorized, funded, or undertaken that might adversely affect EFH. As part of the nationwide BE prepared for the Proposed Action (Appendix C) (FEMA, 2015b), FEMA prepared a separate EFH Assessment, which is summarized here.

In general, marine and estuarine habitats for EFH species are any ocean or estuarine waters or substrate necessary for the fish to spawn, breed, feed, or mature; these habitats include nearshore and offshore waters and extend from the shoreline to the Exclusive Economic Zone (EEZ), which is the area between 3 nautical miles (or 9 nautical miles, in the case of Texas, western Florida, and Puerto Rico) and 200 nautical miles of ocean that extend from the United States coast, or the coast of any territory over which the United States exercises sovereignty. Within the EEZ, the United States has the right to conserve and manage the natural resources of those waters and substrates, including implementation of the MSA (NOAA, 2015d). To describe the EFH designations concisely at a national level, they have been grouped into the six categories presented below.

3.7.3.6.1 Anadromous EFH

EFH is designated for several species of anadromous fish that migrate into freshwater systems to spawn but spend the majority of their life cycle in the marine environment. EFH for anadromous species includes freshwater areas (e.g., rivers, streams, and forested wetlands), bays and estuaries, and nearshore and offshore marine waters. The Pacific FMC manages the fisheries for coho, chinook, and Puget Sound pink salmon; freshwater EFH for these species includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California (Pacific States Marine Fisheries Commission, 1999).

The North Pacific FMC manages the fisheries for chinook, chum, coho, pink, and sockeye salmon. In bays, estuaries, and marine waters, EFH for these species extends from Alaska to the EEZ limit. In freshwater, salmon EFH includes all the lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon in Alaska.

The EFH for Atlantic salmon, managed by the New England FMC, is all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. Oceanic adult Atlantic salmon are primarily pelagic and range from the waters of the continental shelf off southern New England north throughout the Gulf of Maine (New England Fishery Management Council, 1998).

3.7.3.6.2 Nearshore Marine/Estuarine EFH

Nearshore marine/estuarine EFH is designated for a number of fish, sharks, and invertebrate species that use estuaries, bays, and nearshore marine waters; for example, herring, sardines, sandbar shark, red drum, bull shark, bluefish, and surf clam (NOAA Fisheries, 2015c). These species generally spend all or most of their life (egg-larvae-juvenile-adult-spawning) within the estuarine or nearshore marine water column. Nearshore marine/estuarine habitat includes the open waters of estuaries and bays, and nearshore marine waters along the surf zone and shoreline. Estuarine habitats also include intertidal habits associated with bays and estuaries such as nonforested wetlands (e.g., salt marsh and mud flats), forested wetlands (e.g., mangrove forest), and estuarine and aquatic plant and algal beds (seagrass, kelp, etc.). EFH for nearshore marine/estuarine species is managed by the Gulf of Mexico, Mid-Atlantic, New England, North Pacific, and South Atlantic FMCs.

3.7.3.6.3 Nearshore Marine/Estuarine Benthic EFH

Nearshore marine/estuarine benthic fish and invertebrates live on, in, or near the bottom of shallow waters of bays and estuaries and nearshore marine waters, often in areas shallow enough to support photosynthesis. Some examples of nearshore marine/estuarine benthic species with EFH include yelloweye rockfish, Guam and Hawaii bottomfish, sea scallop, thorny skate, and summer flounder. Nearshore marine/estuarine benthic EFH includes many types of bottom habitats, such as submerged banks, benthic algae, kelp beds, seagrass beds, sand/shell bottoms, soft and hard bottoms, and gravel/cobble substrate. Nearshore marine/estuarine benthic EFH also includes rocky reefs (submerged rock outcrops and boulder fields) found at a range of relief and depths that provide shelter, and sometimes a food source with the colonization of algae, for small and juvenile fish as well as invertebrates and fish species. Nearshore marine/estuarine benthic habitats also include the water-sediment interface used primarily by juvenile and adult invertebrates. The water-sediment interface is generally composed of the areas from the seafloor into the sediment to a depth of one meter. Nearshore marine/estuarine benthic species generally spend all or most of their life cycle (egg-larvae-juvenile-adult-spawning) at the seafloor, although some species have a planktonic egg or larval stage in the water column that allows dispersal. EFH for nearshore marine/estuarine benthic species within the EEZ is managed by all eight FMCs.

3.7.3.6.4 Offshore Marine Benthic EFH

Offshore marine benthic fish and invertebrates live on, in, or near the bottom of deeper, offshore marine waters that are typically too deep to support photosynthetic organisms. Some examples of offshore marine benthic species with EFH include spiny dogfish, Arctic cod, ocean quahog, and snow crab. Offshore benthic EFH occurs in all oceans which border the United States and its territories, and includes many types of bottom habitats, including submerged canyons, and the continental shelf and slope. Seamounts (submerged mountains) in offshore marine waters are a particularly important type of rocky reef and provide a productive and nutrient-rich environment in otherwise nutrient-deprived deep open ocean waters (NOAA Fisheries West Coast Region, 2015). Offshore marine benthic habitats also include the water-sediment interface used primarily by juvenile and adult invertebrates, such as clams, marine worms, and burrowing crustaceans. The water-sediment interface is generally composed of the areas from the seafloor into the sediment to a depth of one meter (North Pacific Fishery Management Council, 2014). Offshore marine benthic species generally spend all or most of their life cycles (egg-larvae-juvenile-adult-spawning) at or near the sea floor, although some species have a planktonic egg or larval stage in the water column that provides a means of dispersal. All eight FMCs manage EFH for offshore marine benthic species within the EEZ.

3.7.3.6.5 Pelagic EFH

Pelagic EFH consists of offshore marine waters and is designated for a number of pelagic species (those that primarily live in the water column away from the bottom), including tuna, pelagic sharks, billfish, and wahoo (NOAA Fisheries, 2015c). Pelagic EFH in the EEZ includes offshore marine waters associated with features such as sea mounts, submerged banks and canyons, floating algal beds (Sargassum), and the continental shelf. Locations of pelagic species populations within the water column are highly dependent on and shift seasonally in response to water temperatures. In addition, many pelagic species migrate vertically within the water column on a daily basis to feed or avoid predation (Pacific Fishery Management Council, 2011). Pelagic species generally spend all or most of their life cycle (egg-larvae-juvenile-adult-spawning) within the marine water column. The Mid-Atlantic, New England, Pacific, and South Atlantic FMCs manage EFH for pelagic species within the EEZ.

3.7.3.6.6 Coral Reef EFH

EFH is designated for coral reef ecosystems and several fish and invertebrates that reside in coral or artificial reefs in marine nearshore waters and nearshore waters of bays and estuaries, including spiny lobster, queen conch, rainbow parrotfish, reef sharks, and sand tilefish. Characteristics of coral reefs are the presence of living and dead coral, calcium carbonate deposits, and high biodiversity (NOAA Fisheries, 1999). Coral reefs can be found in nearshore tropical or temperate marine waters in a wide range of latitudes and depths, although they are most common in tropical, shallower waters (NOAA, 2015e). The high biodiversity of coral reefs provides food, shelter, and breeding opportunities for a number of fish and invertebrate species. Reef corals represent a unique situation since in most cases they include the main component of their own habitat, the coral reef. Therefore, the condition of the coral species reflects the condition of their habitat. If corals are dead or dying, the coral reef is likely to degenerate. Many other organisms, including commercially important species (e.g., spiny lobster, rockfish, and grouper), rely on corals, directly or indirectly, for shelter, food and as spawning sites (Goenaga & Boulon, Jr., 1992).

Artificial reefs include human-made structures that provide three-dimensional relief above the seafloor created by purposeful or incidental deposition of materials (e.g., shipwrecks and concrete structures placed on the seafloor). Artificial reefs provide shelter and feeding opportunities for a variety of fish species, as well as surface area for settlement, attachment, and colonization by benthic organisms, and are often used to enhance habitat in areas where natural reefs have been degraded.

Reef inhabitants generally spend all or most of their life (egg-larvae-juvenile-adult-spawning) within the reef environment. The South Atlantic, Gulf of Mexico, Western Pacific, and Caribbean FMCs have FMPs in place for all of the coral reef ecosystems; these ecosystems provide habitat for a variety of coral species and several hundred fish and invertebrate species. Some examples of Reef habitats managed by these FMCs include soft and hard coral reefs, live/hard bottoms, and aquacultured live rock (NOAA Fisheries, 2015d).

3.7.3.7 Wetlands

The USFWS defines wetlands as "… lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface" (Cowardin, Carter, Golet, & LaRoe, 1979). The definition of wetlands under Section 404 of the CWA is "… those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (EPA, 2017).

Floodplains often contain coastal and inland wetlands and other important ecological areas that are critical components influencing the overall quality and function of the local biological environment. Wetland vegetation also helps filter and isolate floodplain contaminants. The ecological integrity of floodplain wetlands depends on the supply of water, sediment, and nutrients; the stability of the system; the methods and rates of plant colonization; the rates of plant growth and decay; and the amount and type of organic matter contributed to the waterbody. (Association of State Floodplain Managers, 2008)

Independent of classification type and location, all wetlands provide ecosystem functions that benefit both the natural and human environments, including (EPA, 2015h) (EPA, 2012g):

- Habitat for terrestrial and aquatic species of flora and fauna;
- Stop over habitat and breeding grounds for waterfowl and other migratory birds;
- Habitat for ESA-listed species—more than one-third of United States ESA-listed species live only in wetlands, and nearly half use wetlands at some point in their lives;
- Habitat for commercial species of fish/shellfish and game animals;

- Storage and slow release of floodwaters and stormwater runoff;
- Shoreline stabilization;
- Groundwater recharge, water filtration, and erosion control; and
- Scenic and recreational value.

Throughout the United States, wetland types vary widely because of regional and local differences in vegetation, soils, topography, climate, hydrology, and water chemistry. The most recently available data identify an estimated 110.1 million acres of wetlands in the United States as of 2009; about 95 percent of these wetlands were freshwater and 5 percent were marine or estuarine (saltwater) systems (Dahl, 2011). The modified Anderson classifications include two broad categories of wetlands: forested wetlands and nonforested wetlands. Throughout the various physiogeographic regions, these two wetland types can exist independently or can form wetland complexes containing a variety of wetland plants, soils, and water regimes. It should be noted that "wetlands" as defined in this document are more inclusive than the statutory definition of wetlands applicable to USACE permitting activities under Section 404 of the CWA (see Section 3.7.3.7).

Forested wetlands are perennially or intermittently flooded freshwater or saltwater lowland areas dominated by woody vegetation, such as trees and shrubs. Trees and shrubs present in a forested wetland may be deciduous, coniferous, or a mixture of both. Some typical characteristics of a forested wetland include a complex food web of organisms, canopy cover, leaf litter, hydric soils, hydrophytic (i.e., water-adapted) vegetation, and the presence of a seasonal or permanent body of water that may be large (e.g., rivers and lakes) or small (e.g., streams or springs). Forested wetlands include forested riparian (i.e., streamside) areas, mangrove forests, wooded swamps and bogs, and lowland forested areas with seasonal flooding or water at or near the ground surface for at least part of the year.

Nonforested wetlands are perennially or intermittently flooded freshwater or saltwater lowland areas dominated by herbaceous vegetation, such as mosses and emergent plants, or are not vegetated. Some typical characteristics of a nonforested wetland include a complex food web of organisms, open space, hydric soils, hydrophytic vegetation, and permanently or seasonally wet ground, possibly including small waterbodies. Nonforested wetlands include freshwater meadows, open bogs, salt marshes, and wet prairies.

Wetlands occur in each physiogeographic region and are a dominant land cover in four of the eight regions (see Table 3-17). General descriptions of forested and nonforested wetlands within each region are provided below.

3.7.3.7.1 Alaskan Arctic Plain Physiogeographic Region

This region is dominated by upland tundra, with wetlands occurring in lowland areas. The permafrost layer in this region acts a drainage barrier underneath the ground surface during snow melts and precipitation events resulting in saturated soil layers. These saturated conditions support the many wetland systems occurring in the region (Alaska Department of Fish and Game, 2001). The freezing temperatures that are present for much of the year reduce evaporation, allowing for persistence of water within the wetland systems (Alaska Rangelands, undated).

Forested wetlands do not typically occur in this region because thick permafrost layers and the arctic climate prevent the establishment of viable woody plant communities (National Snow and Ice Data Center, 2015), although low-growing shrubs sometimes occur along waterways where subsurface flow prevents deep freezing.

Nonforested wetlands include vernal pools, bogs, fens, and marshes with vegetation adapted to short growing seasons, cold temperatures, and high winds. Vernal pools have either bedrock or a hard clay layer that helps retain water. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. Unique types of nonforested wetlands in this physiogeographic region are pingos and ice wedges. Pingos are mounds of earth-covered ice that occur in permafrost areas. Wetlands form when the ice melts, creating a depressional area that collects and holds water. Ice wedges are areas where water flows into soil cracks and is trapped and frozen by surrounding permafrost. The cracks develop during the cold winter months when the soil is contracting. The frozen water expands and displaces the surrounding soil. When snowmelts occur, these areas fill with water (Alaska Department of Fish and Game, 2001).

3.7.3.7.2 Subtropical Islands Physiogeographic Region

Wetlands in this region contain species adapted to a hot, humid climate, flooding, and salinity fluctuations (USGS, 1996b). Forested wetlands in this region are typically located in coastal areas and along streams and rivers and are dominated by salt-tolerant species, such as mangroves, often growing in brackish to saline waters. Nonforested wetlands in this region include bogs and marshes dominated by species such as sedges, ferns, and mosses.

3.7.3.7.3 Mountains Physiogeographic Region

Wetlands are freshwater systems that occur along stream and lake margins, and in depressions, riparian zones, and spring seeps. The climate varies across the Mountain Regions based on geographic location; microclimates in this region are also affected by factors such as altitude and location (i.e., whether an area is located on the windward or leeward side of a mountain) (Encyclopedia Britannica, 2014). Forested wetlands vary in species composition based on elevation (Rahbek, 1995). Tree presence and species diversity decline at higher elevations (the edge of the timberline). The most species-rich forested wetlands in this region tend to occur in areas where the local microclimate, hydrology, and landscape allow for sustainable growth. Representative forested wetland species in this region include firs, aspens, and cottonwoods. Nonforested wetlands in this region occur at various elevations, including above the timberline. Not unlike forested wetlands, species composition of nonforested wetlands in this region is a product of elevation and the local microclimate, hydrology and landscape (Rahbek, 1995). Many of the nonforested wetlands in this region are situated in areas that collect and concentrate rainfall and sheet-flow runoff, such as valley bottoms, depressional plateaus, and spring seeps. Representative nonforested wetland species in this region include rushes, ferns, mosses, and grasses.

3.7.3.7.4 Pacific Coast Physiogeographic Region

Wetlands occur in the lowland, transitional areas at the edge of the mountain regions and extend west to the Pacific Ocean. The climatic conditions within this region vary widely, from warmer conditions in the southern extents to cooler, subarctic conditions in the northern extents. Wetlands vegetation within the region tends to be more diverse in the contiguous United States than in Alaska due to the climatic differences. Forested wetlands in this region comprise forested or woody shrub areas along stream margins and in swamps in the southern portion, and low-growing shrubs with few large trees along streams in the northern portion. Examples of forested wetland species found in this region include cottonwoods, willows, cedars, and alders. Nonforested wetlands in this region vary in species composition across the climatic gradient of the region. All nonforested wetlands are dominated by herbaceous species, and some include areas of open water. These wetlands include salt marshes, freshwater marshes, bogs, fens, vernal pools, wet meadows, and other open-canopy systems. Wet meadows commonly occur in poorly drained areas such as shallow lake basins, low-lying depressions, and the land between shallow marshes and upland areas. Since precipitation generally serves as the primary water supply, these wetlands are often dry during the summer (EPA, 2015i). Representative nonforested wetland species in this region include grasses, sedges, rushes, and mosses.

3.7.3.7.5 Atlantic/Gulf Coast Physiogeographic Region

Wetlands have a wide variety of characteristics because this region spans thousands of miles of coastline and extends landward to include freshwater systems. Many of the wetlands in this region are situated in the lowland areas of the eastern United States and Gulf of Mexico. Climatic conditions range from hot and humid in the southern portions of the region to temperate in the north, with cooler temperatures dominating the northernmost extent. The expanse of this region contributes to seasonal variations in vegetation growth and species composition. Forested wetlands in this region are often swamps in broad floodplains that receive floodwater from nearby rivers and streams (EPA, 2015i). Forested wetlands in the region vary widely from communities of mangroves in the south to deciduous and deciduous/coniferous mixed communities in the north. These latter communities include species such as hemlock, ash, maple, oak, and alder. Examples of forested wetland functions in this region include sediment and storm water retention, wildlife habitat, and groundwater recharge. Nonforested wetlands in this region include primarily wet, herbaceous systems within portions of the region's many estuaries, bays, and sounds. Representative nonforested wetlands in this region include salt marshes along the coastlines, tidal freshwater marshes upstream of estuaries, inland freshwater swamps, and riparian wetlands. Tidal systems are influenced by the ebb and flow of the tide and often by freshwater input from stormwater runoff, rivers, or groundwater. Salt marshes have one of the highest rates of primary productivity associated with wetland ecosystems because of the inflow of nutrients and organics from surface and/or tidal water. Tidal freshwater marshes lack the salt stress of brackish waters, and therefore support a greater diversity of plant life. Freshwater marshes receive most of their water from surface or groundwater and have mineral, hydric soils that are either permanently or intermittently flooded (EPA, 2015i). Nonforested wetlands in this physiogeographic region support several species of cattails, ferns, sedges, and rushes.

3.7.3.7.6 Arid West/Southwest Physiogeographic Region

Wetlands are relatively rare because the climate of the region lacks significant rainfall and is seasonally hot and dry. These conditions that do not support development and sustainment of wetlands. Although rare, wetlands in this region are a critical part of the ecosystem because they provide seasonal wildlife habitat and a source of fresh water in an otherwise arid landscape. Forested wetlands in this region occur in areas near water sources, such as rivers, streams, or lakes, and within depressional areas within upland forested areas where rainfall collects. Examples of forested wetland species found in this region include willow, mesquite, and elderberry. Nonforested wetlands in this region consist of open water areas, vernal pools, springs, and seeps. Examples of nonforested wetland species found in this region include saltgrass, cattail, rushes, mosses, and sedges.

3.7.3.7.7 Great Plains Physiogeographic Region

Within this region, wetlands vary greatly in size, vegetative composition, and landscape location. This region has a range of microclimates that tend to be temperate in nature, with cooler extremes to the north and warmer extremes to the south. The large expanse of this region includes many different types of landscapes, river systems, and geologic formations. Wetlands in this region are critical for migrating waterfowl in the prairie pothole areas, provide expansive areas of wildlife habitat, and serve a significant floodwater retention function for the many floodplains of the extensive river systems in the region. Forested wetlands in this region include large forested riparian corridors, forest-interior vernal pools, and forested swamps, marshes, and bogs. Examples of forested wetland species found in this region include buckeye chokeberry, birch, and hickory. Nonforested wetlands in this region include vernal pools, wet prairies, prairie potholes, wet meadows, and swamps where there is either no vegetation or herbaceous vegetation without dominant woody growth. Wet prairies are similar to wet meadows, but remain saturated longer. Wet prairies may receive water from intermittent streams, groundwater, and precipitation. Prairie potholes develop when snowmelt and rain fill the pockmarks left on the landscape by glaciers. Groundwater input is also important to nonforested wetlands in this region. In the southern United States, playas are present. Playas are small, low-lying basins that collect rainfall and runoff from the surrounding land (EPA, 2015i). Examples of nonforested wetland species found in this region include grasses, sedges, cattails, mosses, and rushes.

3.7.3.7.8 Great Lakes Physiogeographic Region

Wetlands include all freshwater systems within the Great Lakes Basin. The temperate climate of this region subjects wetlands to warm summers and cold winters. These seasonal affects result in a fluctuation in species composition; during the warm growing season, floral species flourish, while during the winter months, herbaceous species die back. Wetlands in this region are important for migratory and resident waterfowl survival, sediment, and nutrient control within the Great Lakes systems, and protection/support of fisheries within the Great Lakes. Forested wetlands in this region are situated in lowland areas, and are dominated by either deciduous or coniferous species. In some instances, elements of deciduous and coniferous systems overlap in transitional areas. Examples of species found in these systems include birch crowberry, ash, and tamarack. Nonforested wetlands in this region include bogs, fens, and riparian areas not dominated by woody cover. Similar to the forested wetlands, many nonforested wetlands are situated in lowland areas. In some areas, nonforested wetlands occur as pockets of open areas in forested systems. Examples of species found in these systems include maritime grasses, sedges, rushes, and cattails.

3.8 CULTURAL RESOURCES

Unit of Analysis
FEMA Regions

3.8.1 Definition of the Resource

Cultural resources are evidence of human development in the physical environment. Such resources may be of national significance or important only to local communities. Cultural resources include archaeological sites, historic buildings, traditional communities, and cultural institutions. Cultural resources also may include landscape features, geographic expanses and materials significant to ethnic or cultural groups, such as Native Americans, Alaskan Natives, Native Hawaiians, and Pacific Islanders.

This section focuses largely on historic properties, the largest set of identified cultural resources, and the National Historic Preservation Act of 1966 (NHPA), as amended (54 U.S.C. 300101 et seq.), further discussed in Section 3.1.2.1. The term "historic properties" specifically relates to the definition found in 36 C.F.R. § 800.16(l)(2). Historic properties include historic districts; archaeological sites; traditional cultural properties (TCPs),[43] buildings and structures; or objects that have been included in, or are eligible for inclusion in, the National Register of Historic Places (NRHP). Codified in 1966 as part of the NHPA, the NRHP is a list of significant historic properties administered by the National Park Service (NPS). Federal guidance (set forth in *National Register Bulletin 15*) establishes Criteria of Significance and integrity against which historic properties are measured (NPS, 1990). These standards stipulate that for a property to be listed in the NRHP or as defined as a TCP, it must be largely intact or undisturbed; must possess historical, architectural, or engineering significance; and/or must possess some value in terms of its potential for research. The Secretary of the Interior also designates exceptionally significant historic properties as National Historic Landmarks (NHLs) (NPS, 2014c). These NHL properties, which are listed in the NRHP, are particularly illustrative of the heritage of the United States. Exampes of NHL properties include Independence Hall in Philadelphia, PA where the Declaration of Independence was drafted, and Little Rock Central High School, in Little Rock, AK, site of the first major confrontation in 1957, in response to implementation of the Brown v. Board of Education 1954 Supreme Court ruling declaring that separate but equal education was unconstitutional.

This section presents overviews of the: 1) prehistory and history of the United States and its associated territories; 2) types of cultural resources (including historic properties and TCPs); and 3) federally recognized tribes and reservations along with other Federal lands. Consideration of cultural resources is of particular importance to the NFIP because of the high frequency with which they occur near sources of water. The unit of analysis for this section, FEMA Regions, was selected to logically group cultural resources by geographic/administrative boundaries. The overview in this section of the NPEIS is not a comprehensive report or inventory of cultural resources in the United States. Refer to Section 3.1.1 for a more detailed overview of the FEMA regions.

3.8.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. A discussion of the applicable laws and regulations for Cultural Resources are described below.

---

[43] A Traditional Cultural Property (TCP) is a type of historic property that is eligible for inclusion in the NRHP based on its association with cultural practices or beliefs of a living community that are rooted in the community's history and are important in maintaining the continuing cultural identity of the community.

3.8.2.1 National Historic Preservation Act of 1966

The NHPA, as amended (54 U.S.C. 300101 et seq.), expands consideration of historic and archeological properties to include those of national, State, and local significance. Under the NHPA, significant cultural resources, referred to as historic properties, include any prehistoric or historic district, site, building, structure, object, or landscape included in, or eligible for inclusion in, the NRHP. A property is considered historically significant if it meets one of the NRHP criteria and retains sufficient historic integrity to convey its significance. The NHPA also established the Advisory Council on Historic Preservation (ACHP), an independent agency responsible for implementing Section 106 of the NHPA (Section 106) by developing procedures to protect cultural resources included in, or eligible for inclusion in, the NRHP. Relevant regulations are published in 36 C.F.R. § 60 and 36 C.F.R. § 63, and 36 C.F.R. § 800.

Section 106 of the NHPA requires Federal agencies to take into account the potential effects of agency actions on properties listed on or eligible for the NRHP, including lands that may hold cultural significance for Indian tribes or Native Hawaiian organizations, in consultation with the State Historic Preservation Officer (SHPO), the Tribal Historic Preservation Officer (THPO) of federally recognized tribes, and if participating, the ACHP. The regulations implementing the NHPA define "undertaking" as "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including (a) those carried out by or on behalf of the agency; (b) those carried out with Federal financial assistance; and (c) those requiring a Federal permit, license, or approval" 36 C.F.R. § 800.16(y). The Federal agency is responsible for determining whether its actions are undertakings (36 C.F.R. §800.3(a)). In making that determination, the Agency should examine the nature of its Federal involvement taking into consideration factors such as the degree of Federal agency control or discretion; the type of Federal involvement or link to the action; and whether or not the action could move forward without Federal involvement (64 FR 27044, May 18, 1999). Under the NHPA, FEMA must identify undertakings that might affect historic properties, identify potentially affected historic properties, assess the potential adverse effects of its actions on those properties, and seek ways to avoid, minimize, or mitigate those effects.

3.8.3 Existing Conditions—The Prehistory and History of the United States

3.8.3.1 Prehistoric Overview

General overviews of North American prehistory link the stages of cultural development to geographic regions across the continent. The prehistory of each of these regions reflects unique cultural adaptations to varied natural settings and resources. Figure 3-23 represents the prehistoric cultural chronology for each of FEMA's regions. These regions, as shown in Figure 3-22, include Alaska, the Northwest Coast, California, the Plateau and Great Basin areas, the Southwest, the Great Plains, the Northeast, and the Southeast (Jennings, 1974). Puerto Rico and the USVI are subsets of the greater Caribbean cultural area, which had cultural ties to the Southeast. The cultures of the American Pacific islands, including Hawaii, also present a different cultural trajectory and prehistoric settlement chronology from that of the contiguous United States.

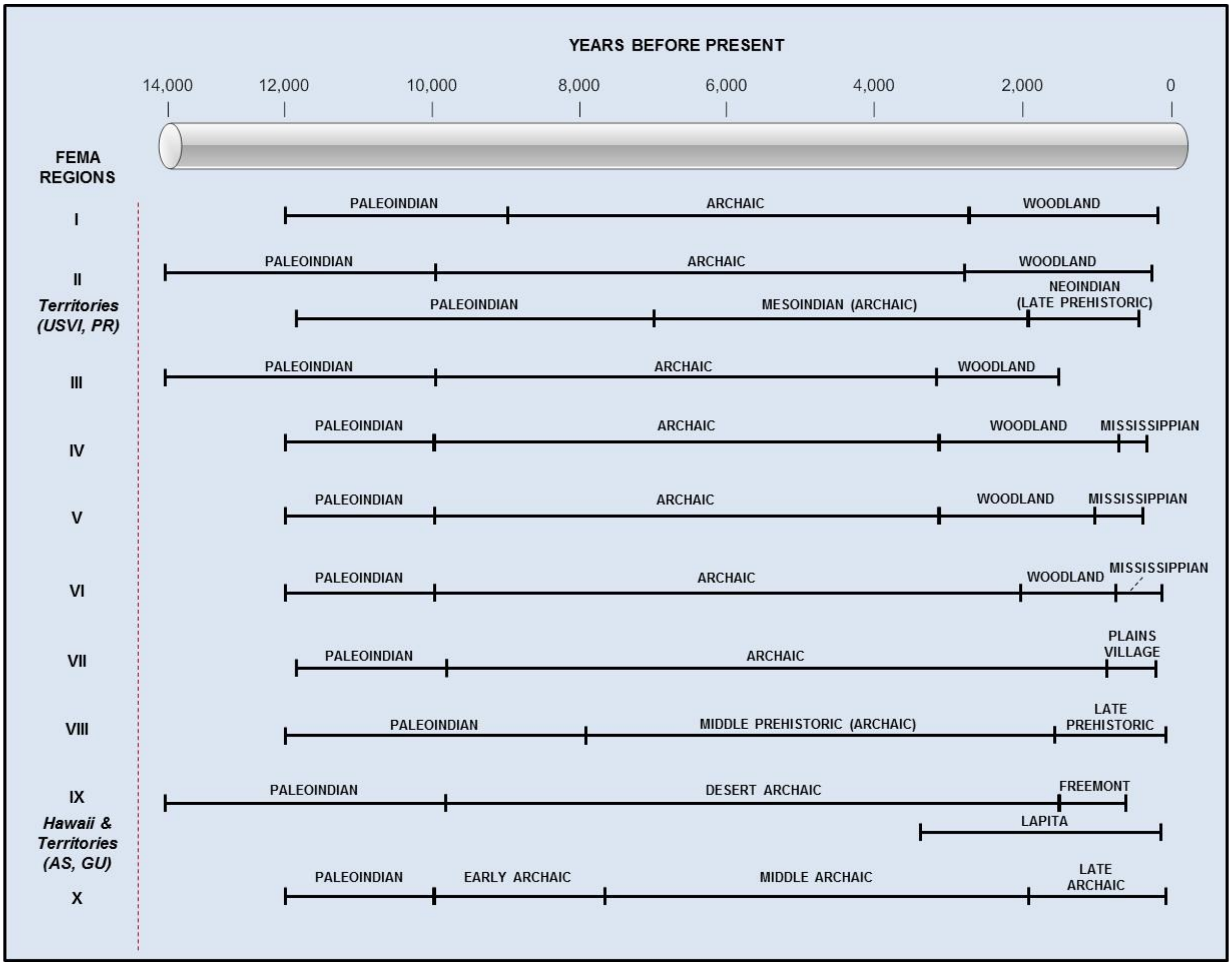
The prehistoric cultural development of North America reflects increasing complexity and variability in technology over time, a wide range of regional adaptations to environmental zones, and a gradual emergence of sedentary village life that centered on water-dependent horticulture, agriculture for subsistence, or the advent of dependable fishing technology (in the cases of Alaska, the Northwest Coast, and the estuarine Southeast).

Source: (Jennings, 1974)

Figure 3-22: Cultural Development to Geographic Regions across North America

The earliest inhabitants of North America hunted now-extinct Pleistocene-era game like mammoths and the precursors of modern bison, as well as small game and birds, and collected an array of plant resources. These Paleoindian peoples (refer to Figure 3-23) were highly mobile as they pursued migratory game species that were probably hunted to extinction toward the end of the Pleistocene. The continent-wide presence of the same basic artifacts from this period indicates a mobile lifestyle that came to a close as the climate became warmer and drier.

Across the United States, Archaic-period sites (refer to Figure 3-23) were distributed across a wider range of environmental zones than had been exploited during the Paleoindian stage. In the East, Great Plains, and Texas, larger Archaic base camp sites have been discovered near places that produced predictable animal and plant resources, such as the terraces of major rivers and larger streams. The use of plant foods, including seeds and nuts, intensified over time, as did shellfish harvesting and fishing in coastal areas and along river systems. Indigenous populations increased across the continent during the Archaic Stage, a trend that generally continued until the arrival of the first European explorers and settlers.



Source: (Jennings, 1974)

Figure 3-23: Prehistoric Cultural Chronology

3.8.3.2 Paleoindian Stage (40,000 to 10,000 B.P.[44])

The earliest stage in North American prehistory was the Paleoindian Stage. Its diagnostic artifacts have been recognized and dated from sites across the continental United States. A narrow range of well-made, fluted lanceolate—or lance-like—projectile points is recognized as the definitive tool of the continent-wide Clovis culture, which is generally known as the earliest widespread human occupation of North America. Clovis points and their associated tool kits first were defined at the Blackwater Draw site near Clovis, NM,

[44] Before Present

and elements of the Clovis tool kit have been found from Alaska and the Northwest Coast south to the Mexican border (Gramly, 1996) (Gramly, 1998). The Clovis tool kit distribution also extends to the eastern seaboard from New England south to Florida, including the Shenandoah Valley of Virginia (Gardner, 1974) and the Delaware River Valley of Pennsylvania (McNett, 1985).

The Clovis period was followed by the Middle and Late Paleoindian periods (Anderson, 1990) (Bense, 1994), both of which are defined by stylistic changes in projectile point types. Paleoindian inhabitants of North America hunted now-extinct Pleistocene game like mammoths and the precursors of modern bison, as well as small game and birds, and collected an array of plant resources. Paleoindian tools have been recovered in direct association with butchered mastodon bones at a site in Tennessee (Breitburg, 1996). Paleoindian peoples were highly mobile; they pursued migratory game species that were probably hunted to extinction toward the end of the Pleistocene. The continent-wide presence of the same basic Clovis and post-Clovis tool kits, which apparently were designed strictly for hunting and butchering large mammals, indicates a mobile lifestyle that came to a close as the climate became warmer and drier. These more moderate conditions, which coincided with the beginning of the Archaic cultural stage around 10,000 years ago, as the glacial ice cap began to recede at the end of the Pleistocene climatic epoch (Ice Age) (Anderson, 1990).

3.8.3.3 Archaic Stage (10,000 to 4,000 B.P.)

The Archaic Stage is identified by distinctive changes in stone tool technology that were linked directly to changing climatic conditions at the end of the Ice Age. In the Eastern United States, mixed stands of oak and hickory replaced the mixed open grasslands and spruce forests of the earlier Pleistocene (Carbone, 1976). In coastal areas, sea levels rose as glaciers melted and receded. Some areas of the continent became more arid, while other water-rich areas became the gathering places for modern game mammals like deer, elk, and moose (Virginia Department of Historic Resources, undated).

Willey and Phillips (Willey & Phillips, 1976), who authored the most comprehensive study of the theory and practice of archeology in North America, characterized the Archaic Stage as a time when migratory hunting and gathering adapted to environmental conditions similar to those of the present day. Archaic projectile points changed from earlier forms that tipped spears to notched points; these points would be hafted (attached) onto wooden shafts for use with spear-throwers (atlatls) and/or detachable-shaft lances. These changes are linked to the exploitation of solitary game species that emerged during the early Holocene period. The shift to the Archaic stage was also distinguished by the large-scale manufacture and use of ground stone implements; tools that suggested an increased reliance on wild vegetable foods (like nuts) and woodworking tools that were suited for use in forest environments.

By the Middle Archaic, sites also contained a diversity of flaked stone tools that suggest changing patterns of territorial movement and food acquisition. Late Archaic cultures in the Eastern United States began to manufacture stone bowls, mostly carved from soapstone (steatite). Also during this time, people built more permanent settlements and traveled long distances to trade goods. Some of the stone bowls have been found hundreds of miles from where they were made.. (O'Steen, Ledbetter, Southern Archaeological Services, Elliott, & Lamar Institute, 2002)

Across the United States, Archaic sites were distributed across a wider range of environmental zones than had been exploited during the Paleoindian stage. In the East, Great Plains, and Texas, larger Archaic base camp sites have been located near places that produced predictable animal and plant resources, such as the terraces of major rivers and larger streams. The far broader distribution and greater numbers of Archaic sites indicate intensive and successful adaptation to the moderating climate and to a variety of environmental zones. The use of plant foods, including seeds and nuts, intensified over time, as did shellfish harvesting and fishing in coastal areas and along river systems. Indigenous populations increased across the continent during the Archaic Stage, a trend that generally continued until the arrival of the first European explorers and settlers. (Cobb, 2012)

3.8.3.4 Woodland or Formative Stage (3,000 to 500 B.P.)

The Woodland or Formative Stage (refer to Figure 3-23) especially in the eastern United States, was defined by the adoption of a more sedentary lifestyle, the gradual introduction of horticulture/agriculture, and the development of pottery. Early Woodland sites occupied settings with access to water resources similar to those favored by Late Archaic peoples. The lifestyle appears to have been organized around predictable returns to seasonal camp areas (Pluckhahn, 2003).

In the East and Midwest, the cultures of Early Woodland peoples began to develop more sedentary and regionalized societies, signaling the beginning of the Middle Woodland period. Most Middle Woodland groups in the Northeast and Middle Atlantic occupied small semi-sedentary settlements where the pottery used clearly developed out of the Early Woodland wares. Some of these occupations had large storage pits and oval houses (Virginia Places, Undated).

The Late Woodland period represented an increasing variation of settlement patterns, lifestyles, and complex social and political organization that had begun to emerge during the Middle Woodland. Villages in the Northeast and Middle Atlantic comprised one or more longhouses and subsidiary structures, and were at times surrounded by wooden palisades or defensive fencing (Pennsylvania Historic and Museum Commission, Undated). These settlements represented year-round occupations that were supported by a farming system that was based on corn, beans, and squash. Hunting, fishing, the collection of seasonally available nut species, and in coastal areas, shellfish harvesting, supplemented the plant-based diet (Means, 2014).

The Mississippian period, contemporary with the Late Woodland period along the Atlantic seaboard, was marked by the establishment of complex societies with permanent year-round villages (King, 2002). In some senses, a Woodland stage never developed in California; rather, an enhanced Archaic stage derived from the Great Basin Desert Archaic continued into historic times (Milliken, et al., 2007). Over time, a dichotomy formed between the cultures of coastal groups reliant on aquatic resources and those adapted to the unique environments of the interior valleys, where acorns served as a dietary staple. The Northwest Coast and Alaska witnessed the development of a highly specialized maritime adaptation that led to the establishment of coastal villages near the mouths of major rivers about 3,000 years ago. As with California, initial post-Paleoindian cultural developments in the Northwest showed a strong Archaic-like adaptation to interior forests, supplemented with seasonal fishing camps along the coast (University of Washington, 2015). The general subsistence need for access to fresh water (and, in some cases, salt water for fishing and shellfish harvesting) means that flood zones tend to be higher probability areas for locations of prehistoric archaeological sites.

The stage-based cultural sequence described above is not consistent with the prehistory of the American Pacific and Hawaii. The cultural prehistory of the Polynesian islands in essence skipped what are considered the Paleoindian and Archaic stages of the continental United States. Although people were present in Oceania by 30,000 years ago, Polynesia, which also is known as "remote Oceania," was not settled until about 3,000 years ago. Their cultural complex seems to have included plants and animals like taro and pigs, dogs and chickens that also originated in Asia, and they may have practiced rice agriculture. (West & Foster, Undated)

3.8.3.5 Historic Overview of the United States

Many peoples and cultures inhabited North America prior to European exploration and settlement. These peoples were highly varied, speaking about 1,200 different languages and dialects over North and South America and existing in various stages of development. When European explorers and settlers began arriving on the eastern seaboard of what is now the United States, the Mississippian culture of the Woodland stage was waning. The first settlement in what would become the United States was in 1587 on Roanoke Island, North Carolina. That settlement failed but was followed in 1607 by Jamestown in what is now Virginia. (Jordan & Litwack, 1987)

Human population settlement naturally gravitates towards water, as an essential element to maintaining life and as a mode of transportation. The settlement of North America was no different. Founded and settled via ocean exploration by European explorers during the late 15th and early 16th centuries, the first colonies in the New World were adjacent to the East Coast on the Atlantic and near fresh water sources in the form of rivers, creeks, and dug wells. Since America was viewed as a business venture that would export desirable natural materials to Europe, the proximity to the coast and rivers provided easier access to the ships transporting goods. Most of what is now called New England and the Mid-Atlantic Regions, along with South Carolina, North Carolina, and Georgia, were initially claimed and settled by the English, Dutch, and French. Florida and points south and west, such as Puerto Rico, were initially claimed and settled by the Spanish. The French initially settled New Orleans and Detroit. Each of these countries brought architectural styles, building types, design principles, and folkways to the Americas that influenced settlement planning, the types and styles of buildings constructed, and informed how certain land activities, such as household and farming responsibilities, were conducted. As settlements became more permanent, the rough-hewn original buildings began to incorporate elements from the citizenry's home countries and countries they passed through on their way to the New World.

Aside from the abundant natural resources found in what became the Colonies,[45] the fundamental basis of the local economy was agrarian.[46] The colonies, other than Rhode Island and Connecticut, were founded as investments for trading companies that sought to exploit the natural resources of the continent (Jordan & Litwack, 1987). The bountiful water sources on the Atlantic coast and a seemingly infinite amount of arable[47] land to the west of the coastline encouraged expansion by intrepid individuals and organized groups of settlers. As settlement expanded outward to accommodate the desire for new goods, increased population densities, and more farmland, there was added contact among the Colonies. This contact

[45] The original 13 colonies were New Hampshire, Massachusetts Bay, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia.
[46] Agrarian: Agricultural (farming).
[47] Arable: Able to produce crops.

resulted in the exchange of goods and exposure to building types and styles not previously seen; allowed the populations to experience different folkways, defined as a practice, custom or belief shared by a group as part of their common culture; and aided in the unification of the Colonies over time. (Upton, 1986)

The colonies grew rapidly during the first two-thirds of the 18th century. By 1700, the non-Indian population of the English colonies along the eastern seaboard and New Netherland (New York) was approximately 250,000. The colonies were governed by royally appointed governors, and the colonists were taxed by the English and Dutch governments, respectively. As the scientific and political thought of the Enlightenment (the early to mid-1700s) gained a following, colonists began to chafe at their inability to govern themselves. The 13 colonies declared themselves independent of Great Britain on July 4, 1776; by that time New Netherland had become a British possession called New York. The war that followed ended with Great Britain's surrender in 1781 at Yorktown, VA, although it was not formally ended until the Treaty of Paris was ratified in Philadelphia in 1783. (Jordan & Litwack, 1987)

After the American Revolution expansion of the United States became a focus of both the country's including both the citizens and politicians. The citizenry wanted land, and the political body needed natural resources and defensible borders. The boundaries of the new country were essentially unknown and the newly centralized government began to initiate exploration; the purchase of large tracts of land from other countries, such as the Louisiana Purchase that President Jefferson authorized from France in 1801; and settlement by persons willing to work the land for ownership opportunities. Although most Europeans did not challenge the Americans' right to settle areas west of the Mississippi River, the region was not empty, having been occupied for thousands of years by American Indians. (Jordan & Litwack, 1987)

The United States began to transition from a mostly agricultural nation to a manufacturing powerhouse during the Industrial Revolution. Begun in Great Britain in the early 1700s, the mechanization of textile production came to the United States in 1790 when Englishman Samuel Slater constructed a textile spinning mill in Pawtucket, Rhode Island (Jordan & Litwack, 1987). The production of cloth using powered machinery, rather than being produced by hand at home, spread throughout New England, powered by canals and rivers. The raw materials were provided by the cultivation of cotton in the American south, which greatly expanded after Eli Whitney invented the cotton gin to separate seeds from cotton (Jordan & Litwack, 1987). The growth of mechanized production changed the way Americans lived, especially women and children who would accept low wages from rural areas flooded into cities for jobs in manufacturing (Jordan & Litwack, 1987). Improved methods of transportation such as steam ships and railroads were developed to get products to market (The Industrial Revolution in the United States, 2017). Electricity was harnessed as a power source to accelerate production (Kelly, 2016).

Throughout the period of colonization, revolution, and the formation of a nation, European settlers and Indians had an uneasy relationship. Settlers made consistent forays into areas occupied by Indians, and tensions rose between the groups. Settlers' began to occupy lands east of the Mississippi River that had once been the territory of Indian tribes, especially lands belonging to the Cherokee Indians in Georgia. The administration of President Andrew Jackson orchestrated the removal of Indians from lands in North Carolina, Tennessee, Georgia, Alabama, and Florida through the Removal Act passed in 1830. Tribal members were forced to walk hundreds of miles along what has become known as the Trail of Tears to territories west of the Mississippi River. (Wallace, 1993)

The northern and southern parts of the country turned against each other in 1861. In a civil war lasting until 1865, over 600,000 soldiers from both sides of the conflict died. The North (Union) prevailed, and slavery was outlawed in the United States. President Abraham Lincoln, assassinated just after the war ended, adhered to the Crittendon Resolution, which stated that the purpose of the Civil War was to defend the Constitution and preserve the Union. A reconstruction of the devastated South began. During this time (1865-1877), southern States that had seceded from the United States returned to the Union. . (Jordan & Litwack, 1987)

The Homestead Act of 1862 and subsequent legislation encouraged the expansionism movement westward between the Mississippi River and the Rocky Mountains. The settlers displaced Indians living in these areas, but the Indian tribes, who were skilled hunters and fighters, did not leave peacefully. After 20 years of violence, most Indian tribes were defeated and forced onto reservations by the late 1880s. European settlers rushed to take advantage of the mineral and lumber resources of the West and to raise cattle on the plains. Expansion of railroads across the continent permitted easier movement of products and raw materials and fueled economic growth in the United States. (Litwack, 1991)

Similar to the European expansion to explore and claim overseas territories, the United States began to examine new markets for its manufactured goods, new sources of raw materials, and good harbors for its ships (Litwack, 1991). In 1867, the United States purchased the State of Alaska from Russia. In 1907, the United States began construction of a naval base at Pearl Harbor, HI (Will Chee Planning & Environmental, 2014).

The early 20th century in the United States was characterized by a progressive mindset among the middle class. Tension between laborers, impoverished living conditions, immigration, and corrupt policies were some of the concerns at this time. The 17th Amendment, ratified in 1913, established the election of State senators by the election of American voters. (Litwack, 1991)

Much of Europe entered into war in 1914 after the assassination of Archduke Ferdinand, heir to the throne of the Austro-Hungarian Empire. Faced with the German threat of attack on armed and unarmed sea vessels, and determined to defend the liberties of Europeans, the United States became involved in war on a worldwide scale in 1917 with its entrance into World War I. The Russian Empire, Great Britain, Ireland, France, Italy, Japan, and the United States formed the Allied Powers; Germany, Austro-Hungary, the Ottoman Empire, and Bulgaria formed the Central Powers. Almost 117,000 American soldiers lost their lives in the war. World War I officially ended in 1918 with the signing of the Treaty of Versailles. (Litwack, 1991)

The 18th Amendment, ratified in 1920, prohibited the manufacturing, sale, or transportation of alcoholic beverages within the United States, as well as the import or export of alcoholic beverages. This reform resulted in a rise of organized crime, leading to the repeal of the 18th Amendment with the ratification of the 21st Amendment in 1933. (Litwack, 1991).

The 1920s ushered in a prosperous decade in the United States known as "the Roaring Twenties." The economy revived with demand from Europe for American goods. However, the 1920s closed with a devastating stock market crash in 1929, heralding the beginning of the Great Depression. In an effort to provide work to the unemployed and accomplish public works, the New Deal of President Franklin Roosevelt established programs, like the Civilian Conservation Corps and the Works Progress

Administration. These programs were responsible for providing jobs to thousands of unemployed Americans and building structures and parks across America, many of which remain extant. (Litwack, 1991)

The Imperial Japanese Navy attack on Pearl Harbor Hawaii on December 7, 1941 prompted the United States' involvement in World War II. The Allied powers (United States, Great Britain, France, and Russia) defeated the Axis powers (Germany, Japan, and Italy) in 1945 (Litwack, 1991). American soldiers, sailors, and marines came home to marry, start careers, and have children. The ensuing baby boom was one of the factors leading to the post-war house building boom.

The United States continued to grow until 1959 with the ratification of Hawaii and Alaska as States. In the contiguous 48 States, Arizona and New Mexico were ratified in 1912. Throughout this expansion period, various States and regions took on individual identities that can still be seen in the extant architecture: New England is identified with Colonial styles of architecture; the Deep South is known for antebellum architecture in the Greek Revival style; California is identified with the one story ranch house type along with the Craftsman and Art Deco styles; Illinois and Michigan have maintained their extensive catalogs of Chicago style, Craftsman and Romantic Revival buildings; and New Mexico has stucco and adobe buildings that draw on the Pueblo and Spanish original inhabitants and later explorers.

The early industries in the United States depended on proximity to populations, access to natural resources, and the ability to move the finished product. As with the earliest settlements, water was an important aspect of industrial growth in the United States. On the East Coast, fall line cities allowed industry to move goods down river and harness water power. Industries' early dependence on water resulted in historic industrial resources being subject to flooding events.

State and local governments tended to be established in areas with sustainable populations. As stated above, the proximity to water of the early settlements has resulted in the governments being established in areas prone to possible flood events, such as the Flood of 1851, which essentially destroyed Des Moines, IA and the Flood of 1955 that devastated several towns in Connecticut.

The proximity to water of the original settlements, industry, and government across the United States means that the historic and older parts of towns and cities are frequently at risk for flooding events. The resources impacted could include buildings, other elements of the built environment, planned landscapes, agrarian landscapes, industrial areas, and archaeological sites.

3.8.4 Existing Conditions—Types of Cultural Resources

3.8.4.1 Historic Properties

Cultural resources include properties of historical significance and those important to communities and cultural groups. Most properties listed in or eligible for the NRHP are at least 50 years old. In the case of historic sites, archaeological evidence can be combined with written records to give a fuller picture of the practices, possessions, and life style of past people.

For the purposes of this section, the NHPA regulations for historic properties may also include bridges, gazebos, canals, roads, etc. Historic objects tend to be smaller in scale than structures. The Liberty Bell is a unique example of a historic object. Fountains, monuments, and boundary markers may also be historic objects. The majority of properties listed in the NRHP are historic buildings. The significance of a historic building can be derived from its form, decorative style, architect, or its role in an important event. Houses, theaters, libraries, churches, hospitals, stores, warehouses, and offices are all examples of buildings that can be listed in the NRHP. Buildings may be listed individually or as parts of historic districts.

The Secretary of the Interior may designate exceptional landscapes or natural features as National Natural Landscapes. Landscapes associated with historic events may be classified as historic. Battlefields, for example, are often designated as historic landscapes to better preserve and commemorate those sites. Landscapes can be considered elements of larger historic properties or districts, such as the gardens surrounding George Washington's Virginia plantation, Mt. Vernon.

3.8.4.2 Traditional Cultural Properties

TCPs are historic properties significant for their association with practices or beliefs of a living community that are both fundamental to that community's history and a piece of the community's cultural identity. Although TCPs are often associated with Native American traditions, such properties may also be important for their significance to other ethnic groups or communities. A TCP may be a place that a particular Native American tribe believes is sacred to its origins, or an urban neighborhood that is the traditional home of a particular ethnic group where the group's language, food, and celebrations are still extant (Section 304 of the NHPA).

The NPS has published *National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties* (NPS, 1998). TCPs are evaluated with reference to the *National Register Criteria for Evaluation* (36 C.F.R. Part 60). The entity being evaluated must be a physical property, retain sufficient integrity to sustain its integral relationship to traditional cultural practices or beliefs, and meet one or more of the National Register criteria for significance. The property must also be evaluated against the *National Register Criteria Considerations* (36 C.F.R. Part 60.4) to determine whether the property is ineligible. As noted in NRB 38, "The traditional cultural significance of a historic property…is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices." These properties are eligible for inclusion in the NRHP because of their "association with cultural practices of a living community that (a) are rooted in that community's history and (b) are important in maintaining the continuing cultural identity of the community" (NPS, 1998).

The ACHP has issued guidance regarding cultural landscapes: *Information Paper on Cultural Landscapes: Understanding and Interpreting Indigenous Places and Landscapes* (Advisory Council on Historic Preservation, 2016). Cultural landscapes are defined as "large-scale properties often comprised of multiple, linked features that form a cohesive area or place" (Advisory Council on Historic Preservation, 2016). Cultural and/or historical meanings are attached to these places by peoples who have used, travelled, and "interwoven these places into generations of practice" (Advisory Council on Historic Preservation, 2016).

TCPs often are kept confidential to respect the cultural practices of tribes or communities, and the establishment of a respectful relationship with these tribes is important to provide protection to these resources. Identification of these resources can require specialized and local expertise.

3.8.5 Existing Conditions—Federally Recognized Tribes

As of 2015, approximately 5.3 million Americans claimed American Indian and/or Alaska Native heritage (USCB, Undated). This count includes people of mixed heritage (Department of the Interior, Indian Affairs, 2016). Many, although not all, of these citizens are affiliated with tribes or tribal entities. The Constitution of the United States recognizes a unique relationship between the Federal government and sovereign Native nations. Certain tribes have been federally recognized and are afforded special rights and benefits by law. By 2016, the United States has designated 567 communities as federally recognized tribes, thereby conferring on them recognition of tribal sovereignty and a guarantee to that nation of a government-to-government relationship with the United States (Department of the Interior, Indian Affairs, 2016). This distinction is not afforded to all tribes in the United States and not every State houses federally recognized tribes. Federal recognition does not prohibit members of federally recognized tribes from holding United States citizenship and all rights guaranteed by that status.

Not all federally recognized tribes administer reservations. The United States Government holds approximately 55 million acres of land nationwide in trust for various tribes (Department of the Interior, Indian Affairs, 2016). The Federal government also recognizes allotted lands, those remnants of past reservations divided by the government around the turn of the 20th century; restricted lands, those held by Native American individuals or tribes which require Secretary of the Interior approval to transfer or sell; and, State Indian reservations (Department of the Interior, Indian Affairs, 2016). American Indians, Alaskan Natives, and Native Hawaiians may also own private property outside reservations.

The populations of the United States territories of Puerto Rico, USVI, the Federated States of Micronesia, American Samoa, the Republic of the Marshall Islands, and the Commonwealth of the Northern Mariana Islands include cultural and ethnic groups native to those islands. The legal status of these territories within the United States Government excludes their respective native groups from seeking Federal recognition or administering tribal reservations.

As with other lands within the borders of the United States, Native American reservation lands, allotment lands, and lands held in trust may contain a combination of historic and modern examples of the built environment, and both pre-historic and historic archaeology.

3.8.6 Existing Conditions—Federal Lands

Federal lands are properties owned or administered by the United States Government and represent 28 percent of the 2.27 billion acres within the United States (Gorte, Vincent, Hanson, & Rosenblum, 2012). Federal lands can be found in every State and territory; however, the majority of government holdings exist in the continental west. Federal lands make up more than half the total ground area within the western States of Alaska (approximately 61 percent), Idaho (approximately 61 percent), Nevada (approximately 81 percent), Oregon, (approximately 53 percent) and Utah (approximately 66 percent) with regards to their surface acreage (Gorte, Vincent, Hanson, & Rosenblum, 2012). Primary land holders are the Department of Interior, including BLM, USFWS, and NPS; the United States Department of Agriculture, including the United States Forest Service (USFS); and Department of Defense (DOD). Table 3-18 summarizes the total approximate acreage of Federal lands held by each responsible agency.

The pre-historic and historic resources on Federal land are diverse in terms of type of historic resource, cultural affiliation, condition of resources, and ease of access.

Table 3-18: Federally Owned Lands by Region

	Total for Region I	Total for Region II	Total for Region III	Total for Region IV	Total for Region V	Total for Region VI	Total for Region VII	Total for Region VIII	Total for Region IX	Total for Region X	Total for United States
USFS	1,188,817	44,809	3,221,679	7,305,923	7,992,949	13,777,384	1,953,235	52,176,280	37,850,423	67,397,922	**192,909,421**
NPS	127,566	83,912	466,832	3,443,415	863,061	1,704,378	63,201	6,478,584	11,322,743	55,153,816	**79,707,508**
USFWS	150,941	121,429	230,265	1,614,092	910,607	1,898,444	333,664	1,676,699	4,627,541	77,431,422	**88,995,104**
BLM	0	0	1,353	6,898	3,811	13,520,765	6,354	57,872,019	75,315,661	101,132,215	**247,859,076**
DOD	69,586	232,131	418,800	2,200,422	248,053	4,274,306	292,052	2,263,466	7,304,973	2,207,868	**19,511,657**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

In many cases, Federal lands both encompass and exemplify cultural resources. For example, the National Park System, while home to innumerable cultural resources, also is itself a cultural resource. Moreover, while Bureau of Reclamation lands may encompass individual historic dams, they also collectively represent a historic system of land use and water management. Government-managed lands cover nearly 30 percent of the United States' total area, and thereby host a wealth of individual cultural resources of even greater significance. Prehistoric and historic objects, structures, landscapes, sites and districts, as well as TCPs, are all found within the boundaries of Federal lands.

3.8.7 Existing Conditions—FEMA Region I

FEMA Region I is rich in historic architectural resources due to its early European settlement. Region I also includes the Nantucket Sound, one of the few known TCPs east of the Mississippi. As an illustration of the Region's diversity of cultural resources, Maine currently has over 6,000 identified archaeological sites in its State inventory, and New Hampshire's SHPO recognizes 29 different historic architectural styles.

3.8.7.1 Historic Properties

The types of historic properties in Region I are quite diverse, ranging from prehistoric rock shelters and shell middens[48] to historic railroads. Historic archaeological sites include shipwrecks, mills, military sites, and houses. A few of the above-ground historic property types found in Region I are mills, houses of worship, lighthouses, schools, courthouses, barns, factories, and landscapes. Representative historic architectural types found in Region I include saltboxes, Cape Cod cottages, and churches. The typical architectural styles, generally defined as the features that make a building notable, of historic properties include Colonial Revival, Federal, Gothic Revival, Italianate, Queen Anne, and Stick.

A distinctive subset of the Colonial and Colonial Revival styles is the Dutch Colonial, a style also found extensively in New York. Portions of the northeast are home to a large number of unique architectural resources, both pre-colonial and from the recent past, including the Philip Johnson-designed Glass House in New Canaan, CT, a very important example of Modernist architecture; the Newport Cliff Walk, RI, which serves as an example of Gilded Age mansions; the North End of Boston, MA, which has been continuously inhabited since the early 17th century; and the Renaissance Revival-style Vermont State House in Montpelier, VT. Traditionally founded with a town green, a common public area for gathering, some of the original town planning in Region 1 is still evident and should be taken into account during inventories (NPS, 2013b) (NPS, 2013c).

Table 3-19 lists the number of NRHP-listed properties and NHLs within Region I.

[48] Old dump sites for domestic waste

Table 3-19: Distribution of Listed Historic Properties, Region I

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	Total for Region I
National Register Properties	1,594	1,563	4,247	753	773	831	9,761
National Historic Landmarks	61	44	189	23	45	18	380

Source: (NPS, 2015h)

3.8.7.2 Traditional Cultural Properties

Region I includes at least one known TCP, the Nantucket Sound in Massachusetts, which is listed in the National Register under all four of the Criteria for Evaluation (Shull, 2010). Nantucket Sound is significant for its association with the ancient and historic period of Native American exploration and settlement of Cape Cod and the Islands; as a distinguishable entity integral to the Wampanoag Indians' folklife traditions, practices, cosmology, religion, material culture, food, and narrative; and for the important cultural, historical, and scientific information it has yielded and/or may yield through archaeology, history and ethnography.

3.8.7.3 Federally Recognized Tribes

Nine federally recognized tribes have reservations within Region I. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. One of the federally recognized tribes in Region I, the Narragansett Indian Tribe of Rhode Island, fought State efforts at "detribalization" to hold onto their reservation land (Narragansett Indian Tribe, Undated). Refer to Appendix D for a list of federally recognized tribes by region.

3.8.7.4 Federal Lands

The USFS is the largest Federal land holder in Region I, with more than 1.1 million acres throughout the region, primarily in Vermont and New Hampshire. These lands are primarily designated wilderness areas managed by USFS. Vermont and New Hampshire have the largest number of acres held by Federal agencies in Region I. Table 3-20 lists acreage by landholder for the five major Federal land managing agencies in Region I.

Table 3-20: Federal Land Ownership in Acres, Region I

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	Total for Region I
USFS	24	53,709	None	735,519	None	399,565	**1,188,817**
NPS	5,719	66,898	32,946	13,168	5	8,830	**127,566**
USFWS	1,206	65,987	21,850	25,989	2,369	33,540	**150,941**
BLM	None	None	None	None	None	None	None
DOD	1,608	23,141	26,896	3,131	2,874	11,936	**69,586**
Total By State	**8,557**	**209,735**	**81,692**	**777,807**	**5,248**	**453,871**	**1,536,910**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.8 Existing Conditions—FEMA Region II

FEMA Region II features a diverse mix of cultural resources due to its division between the urbanization of New York and New Jersey and the Spanish and Danish colonial histories of Puerto Rico and USVI. There are over 530 NRHP-listed structures and districts in New York County, New York, and Puerto Rico features historic resources ranging from Spanish colonial fortifications to high-style Modernist buildings of the mid-20th Century that represent an architectural reaction to colonialism.

3.8.8.1 Historic Properties

FEMA Region II contains many types of historic properties. Examples of archaeological properties in the region are prehistoric industrial sites and historic shipwrecks and farms. Above-ground historic properties include railroads, factories, multi-family housing, military facilities, and commercial structures featuring a mix of urban and colonial architecture. Architectural types include brownstone townhouses, rowhouses, and skyscrapers in New York and New Jersey; as well as churches, missions, forts, and plantations. Historic architectural styles include Federal, Gothic Revival, Italianate, Queen Anne, and Shingle, Spanish Colonial, Spanish Eclectic, Moravian, Mid-century Modern, and Danish Colonial. Region II has some of the most diverse design aspects due to the colonial roots of each state/territory; Christiansted, St. Croix, USVI has a combination of African and Danish design due to the Danish use of slave labor to construct the town; parts of New York have distinctly Dutch style influences such as gambrel roof types and divided doors (NPS, 2013b), (NPS, 2013c). Exceptional examples include the Empire State Building in New York City, and Emmaus Moravian Church, St. John, USVI. Table 3-21 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-21: Distribution of Listed Historic Properties, Region II

	New Jersey	New York	Puerto Rico	USVI	Total for Region II
National Register Properties	1,676	5,630	329	88	**7,723**
National Historic Landmarks	58	268	6	5	**337**

Source: (NPS, 2015h)

3.8.8.2 Traditional Cultural Properties

While there are no NRHP-listed TCPs in Region II, New Jersey's Pinelands National Reserve, which has been continuously occupied by humans for over 10,000 years, contains several intact and recognizable areas of significance to Native Americans that meet the NRHP criteria for listing as a TCP.

3.8.8.3 Federally Recognized Tribes

Eight federally recognized tribes maintain tribal lands in Region II. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes by region.

3.8.8.4 Federal Lands

Table 3-22 lists acreage by landholder for the five major Federal land managing agencies in Region II. Federal lands in the territories include the Virgin Islands National Park, which contains 14,737 acres, covering approximately 60 percent of the island of St. John and almost all of Hassel Island, and El Yunque National Forest in Puerto Rico, which contains 28,434 acres and is the only tropical rainforest in the USFS system (USFS, 2012; NPS, 2013d).

Table 3-22: Federal Land Ownership in Acres, Region II

	New Jersey	New York	Puerto Rico	USVI	Total for Region II
USFS	None	16,228	28,434	147	44,809
NPS	35,362	33,483	53	15,014	83,912
USFWS	70,258	27,997	22,584	590	121,429
BLM	None	None	None	None	None
DOD	71,071	133,714	27,234	112	232,131
Total By State	**176,691**	**211,422**	**78,305**	**15,863**	**482,281**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.9 Existing Conditions—FEMA Region III

FEMA Region III features a mix of property types ranging from rural colonial examples to modernist urban structures. The region includes areas of early European settlement, the nationally important Federal government-related historic properties in Washington, DC, and the coastline in the Region is conducive to underwater cultural resources in the form of shipwrecks.

3.8.9.1 Historic Properties

Region III contains a wealth of historic properties. Prehistoric archaeological sites include rock shelters, petroglyphs, and villages. Historic archaeological sites of note include shipwrecks, canals, plantations, forge/furnaces, forts, and battlefields. Above-ground historic properties in the region range from religious buildings, railroads, bank barns, and the L'Enfant plan for Washington, DC to range lights, gunpowder mills, planned suburban communities, and parks built by the Civilian Conservation Corps. Centerhalls, rowhouses, townhouses, mills/industrial complexes/ports, and churches are typical architectural types found in Region III. The Region's historic architectural styles include Federal; Georgian; Neoclassical, Second Empire, Gothic Revival, Greek Revival, Italianate, and International. Notable historic properties include the White House in Washington, DC, and the NHL-designated Spacecraft Magnetic Test Facility at the Goddard Space Flight Center in Greenbelt, MD. The farm tradition in rural Maryland, Pennsylvania, and Virginia is evident in the wide range of farm complexes that show English, German, Swiss, and French influences. An exceptional example in the region is George Washington's home, Mount Vernon, VA. Additionally, there are historic industrial complexes and ports in the region. Table 3-23 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-23: Distribution of Listed Historic Properties, Region III

	Delaware	DC	Maryland	Pennsylvania	Virginia	West Virginia	Total for Region III
National Register Properties	692	565	1,527	3,356	2,941	1,017	**10,098**
National Historic Landmarks	13	74	73	167	121	16	**464**

Source: (NPS, 2015h)

3.8.9.2 Traditional Cultural Properties

The concept of TCPs has most often been applied to Native American settlements, but may also apply to other cultures whose folkways and land use patterns are distinctive. In Region III, the Ardens Historic District in Delaware was identified as a TCP based on its origins and continued use as a community of artists that was founded on such governing principles as the single tax (NPS, 1973).

3.8.9.3 Federally Recognized Tribes

The Pamunkey Tribe is a federally recognized tribe located in Virginia. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land.

3.8.9.4 Federal Lands

The USFS is the dominant Federal land managing agency in Region III, with the majority of those lands in Virginia. The NPS and DOD have a much smaller, but still notable, presence in the region. Table 3-24 lists acreage by landholder for the five major Federal land managing agencies in Region III.

Table 3-24: Federal Land Ownership in Acres, Region III

	Delaware	DC	Maryland	Pennsylvania	Virginia	West Virginia	Total for Region III
USFS	None	None	None	513,418	1,664,467	1,043,794	**3,221,679**
NPS	None	6,942	40,543	50,014	304,289	65,044	**466,832**
USFWS	25,100	None	46,504	9,962	129,566	19,133	**230,265**
BLM	None	None	548	None	805	None	**1,353**
DOD	3,474	1,508	108,391	43,502	258,944	2,981	**418,800**
Total By State	**28,574**	**8,450**	**195,986**	**616,896**	**2,358,071**	**1,130,952**	**4,338,929**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.10 Existing Conditions—FEMA Region IV

FEMA Region IV, which includes States in the southeastern United States, features more historic rural properties than are found in most other FEMA regions. The Georgia SHPO's historic context study for agriculture identifies the State's standards for determining the historical significance of farm buildings, landscapes, and archaeological sites. However, not all notable historic properties are rural; the urban NHL Charleston Historic District in South Carolina contains 81 historic buildings.

3.8.10.1 Historic Properties

Significant historic properties in Region IV include a wide range of prehistoric and historic types. Some of the region's prehistoric archaeological sites are rock shelters, shell middens, burial sites, and stone effigies. Historic archaeological sites include battlefields, shipwrecks, plantations, and cemeteries. The variety of above-ground historic properties includes rice plantations, Rosenwald schools,[49] forts,

[49] Schools constructed in southern States for African American children through the partnership of Julius Rosenwald, a Sears Roebuck executive and Booker T. Washington.

lighthouses, textile mills, railroad depots, quarries, and structures built by the Civilian Conservation Corps such as bridges, park pavilions, recreational cabins, and post offices. Region IV's historic architectural types include shotguns, churches, octagon, and hall and parlor. Examples of notable historic architectural styles in the region are Classical Revival, Colonial Revival, Gothic Revival, Greek Revival, Federal, Italianate, and Queen Anne. One notable urban example of historic properties in the Region is the predominately Art Deco-style Miami Beach Architectural. Further exceptional examples include the Natchez Trace, which is the historic path originally used by Native Americans that extends from Natchez, MS to Nashville, TN, and May's Folly an 1829 Octagonal house listed as a National Historic Landmark. Table 3-25 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-25: Distribution of Listed Historic Properties, Region IV

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee	Total for Region IV
National Register Properties	1,280	1,702	2,086	3,381	1,393	2,877	1,497	2,056	**16,272**
National Historic Landmarks	38	45	49	30	39	38	76	30	**345**

Source: (NPS, 2015h)

3.8.10.2 Traditional Cultural Properties

A TCP of note in Region IV is the Ocmulgee National Monument near Macon, GA. The monument includes earthen mounds and is significant as a place of human habitation for over 17,000 years, producing artifacts from every major period of American Indian history. (NPS, Undated(a))

3.8.10.3 Federally Recognized Tribes

Six federally recognized tribes maintain a physical presence in Region IV. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. The history of Native Americans in the Region includes the Trail of Tears, which was the forced relocation and movement of Native American nations. They were relocated from southeastern parts of the United States to what is now Oklahoma following the Indian Removal Act of 1830 (Wallace, 1993). Refer to Appendix D for a list of federally recognized tribes by region.

3.8.10.4 Federal Lands

Florida contains the largest acreage of Federal lands in Region IV; NPS is the largest Federal landholder in Florida, with more than 2.4 million acres, the majority of which is contained in Everglades National Park. The USFS is the largest landholder in the region, with more than 7.3 million acres and a strong presence in each State. Table 3-26 lists acreage by landholder for the five major Federal land managing agencies in Region IV.

Table 3-26: Federal Land Ownership in Acres, Region IV

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee	Total for Region IV
USFS	670,185	1,176,222	867,199	814,045	1,173,898	1,255,614	630,741	718,019	**7,305,923**
NPS	16,714	2,437,499	39,754	94,395	104,004	363,169	31,538	356,342	**3,443,415**
USFWS	32,207	278,430	482,694	10,938	211,164	419,969	126,653	52,037	**1,614,092**
BLM	3,523	3,134	None	None	241	None	None	None	**6,898**
DOD	148,603	641,526	567,072	163,726	34,266	387,948	109,705	147,576	**2,200,422**
Total By State	**871,232**	**4,536,811**	**1,956,719**	**1,083,104**	**1,523,573**	**2,426,700**	**898,637**	**1,273,974**	**14,570,750**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.11 Existing Conditions—FEMA Region V

Region V includes parts of the Midwest, and features a large number of agricultural-related historic properties, in addition to its urban areas. The diversity of cultural resources in the region is illustrated by the remains of depression-era Civilian Conservation Corps camps in Wisconsin and the largest collection of Frank Lloyd Wright-designed structures in the world, in Oak Park, IL.

3.8.11.1 Historic Properties

Historic properties in Region V include unique prehistoric and historic archaeological sites and historic structures and landscapes. Some of the prehistoric archaeological sites are rock shelters, mounds, and petroglyphs. Historic archaeological sites include Civilian Conservation Corps camps, battlefields, kilns, shipwrecks, and logging camps. The wide variety of above-ground historic properties includes skyscrapers, bridges, canals, casinos, resorts, theaters, amusement parks, automobile manufacturing plants, breweries, and polygonal houses and barns. Historic architectural types in the Region include Barns/Silos, I-House, Foursquare, octagon, and one-room Schoolhouses. Architectural styles include Art Deco, Classical Revival, Gothic Revival, Greek Revival, Italianate, Second Empire, Prairie, Romanesque Revival, Richardsonian Romanesque, and Prairie School. One notable example of an urban historic property is the modernist Mies van der Rohe Historic District in Detroit, MI. Additional exceptional examples in the Region include the Transportation Building in Chicago, IL and the Minnesota Building in St. Paul, MN (NPS, 2013c). Table 3-27 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-27: Distribution of Listed Historic Properties, Region V

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin	Total for Region V
National Register Properties	1,766	1,776	1,831798	1,653	3,895	2,310	**13,231**
National Historic Landmarks	88	40	41	25	72	42	**308**

Source: (NPS, 2015h)

3.8.11.2 Traditional Cultural Properties

An example of a TCP in Region V is the Black Hawk Powwow Grounds, which have been used by the Ho-Chunk for ceremonial and other purposes since the 1800s. These grounds are still in use today by the tribe for events throughout the year. (NPS, Undated(b))

3.8.11.3 Federally Recognized Tribes

There are 27 federally recognized tribes with a physical presence in Region V, the majority of which are in Michigan and Wisconsin. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes by region.

3.8.11.4 Federal Lands

Michigan has the largest acreage of federally owned lands in Region V, with the majority of those lands held by the USFS. Within the region as a whole, USFS is by far the largest landholder, with almost 8 million acres. Table 3-28 lists acreage by landholder for the five major Federal land managing agencies in Region V.

Table 3-28: Federal Land Ownership in Acres, Region V

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin	Total for Region V
USFS	297,713	202,832	2,875,957	2,841,630	241,300	1,533,517	**7,992,949**
NPS	12	10,596	631,718	139,570	19,421	61,744	**863,061**
USFWS	87,886	14,871	115,217	483,787	8,636	200,210	**910,607**
BLM	None	None	None	1,447	None	2,364	**3,811**
DOD	21,123	112,397	15,073	2,777	29,143	67,540	**248,053**
Total By State	**406,734**	**340,696**	**3,637,965**	**3,469,211**	**298,500**	**1,865,375**	**10,018,481**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.12 Existing Conditions—FEMA Region VI

FEMA Region VI, which stretches from Louisiana to New Mexico, features a mix of historic properties including Native American sites, urban areas, and large ranches. Nineteen historic Native American pueblos still exist in New Mexico, and Louisiana has a large number of pre-Civil War plantation homes and associated structures.

3.8.12.1 Historic Properties

Region VI contains historic properties of many types. The prehistoric archaeological sites in the region include mounds, petroglyphs, rock shelters, hunting grounds, and ossuaries.[50] Historic archaeological sites range from shipwrecks and battlefields to cemeteries and forts. Some of the above-ground historic properties in Region VI include cotton gins, water towers, plantations, ranches, cemeteries, streetcar lines, irrigation ditches, and Rosenwald schools. Churches, missions, and shotguns are representative

[50] Ossuaries: Places (rooms) where bones of deceased humans are kept.

architectural types in Region VI. Historic architectural styles include Art Deco, Colonial Revival, Gothic Revival, Mission Revival, Renaissance Revival, and Spanish Colonial. Perhaps the best-known historic properties in the region are the Vieux Carre Historic District, more commonly known as the "French Quarter" in New Orleans, LA, and The Alamo in San Antonio, TX. Table 3-29 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-29: Distribution of Listed Historic Properties, Region VI

	Arkansas	Louisiana	New Mexico	Oklahoma	Texas	Total for Region VI
National Register Properties	2,587	1,400	1,135	1,232	3,177	**9,531**
National Historic Landmarks	16	55	46	22	46	**185**

Source: (NPS, 2015h)

3.8.12.2 Traditional Cultural Properties

A notable TCP in Region VI is the Bassett Grove Ceremonial Grounds in Oklahoma, which has been used by the Seneca-Cayuga People for religious ceremonies since 1832. The oldest portions of the site dates back to 1835, and the site is still used for important religious ceremonies. (Oklahoma State Historic Preservation Office, Undated)

3.8.12.3 Federally Recognized Tribes

There are 64 federally recognized tribes that maintain a physical presence in Region VI, the majority of which are in Oklahoma and New Mexico. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes by region.

3.8.12.4 Federal Lands

New Mexico contains the largest portion of federally owned lands in the region by far, with more than 27 million acres, held primarily by the USFS and BLM. Of note within New Mexico is the U.S. Army's White Sands Missile Range, which at approximately 2 million acres, is the largest military installation in the nation (U.S. Army, 2013). Table 3-30 lists acreage by landholder for the Federal lands in Region VI.

Table 3-30: Federal Land Ownership in Acres, Region VI

	Arkansas	Louisiana	New Mexico	Oklahoma	Texas	Total for Region VI
USFS	2,598,743	604,373	9,417,975	400,928	755,365	**13,777,384**
NPS	98,320	17,531	376,849	10,008	1,201,670	**1,704,378**
USFWS	373,051	564,117	327,264	106,594	527,418	**1,898,444**
BLM	6,078	16,474	13,484,405	1,975	11,833	**13,520,765**
DOD	85,787	127,934	3,395,090	183,831	481,664	**4,274,306**
Total By State	**3,161,979**	**1,330,429**	**27,001,583**	**703,336**	**2,977,950**	**35,175,277**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.13 Existing Conditions—FEMA Region VII

FEMA Region VII includes parts of the Midwest, and, like some other regions, features a mix of rural agricultural and urban areas. The Effigy Mounds National Monument, containing more than 200 Native American-constructed mounds, reflects the region's pre-history; in contrast, St. Louis's numerous NRHP-listed modernist buildings represent the recent past.

3.8.13.1 Historic Properties

The historic properties in Region VII are mostly related to the prehistoric occupation and early settlement of the region. Prehistoric archaeological resources include mounds, lodges, and bison kill sites. Some of the historic archaeological sites are trading posts, stage coach stations, and battlefields. Above-ground historic properties include railroads, Carnegie libraries,[51] schools, post offices, farms, and highways. Examples of historic architectural types in the region are Farmsteads, Gabled Ells, and schoolhouses. Historic architectural styles include Classical Revival, Gothic Revival, and Romanesque Revival. The Gateway Arch in St. Louis, MO; Joslyn Castle in Omaha, NE; and Snake Alley in Des Moines, IA are exceptional historic properties in the region. Table 3-31 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-31: Distribution of Listed Historic Properties, Region VII

	Iowa	Kansas	Missouri	Nebraska	Total for Region VII
National Register Properties	2,232	1,319	2,195	1,078	**6,824**
National Historic Landmarks	25	25	37	20	**107**

Source: (NPS, 2015h)

3.8.13.2 Traditional Cultural Properties

Pahuk Hill, or Mound on the Water, was listed in the NRHP in 1973, prior to the introduction of the TCP concept as a recognized category of cultural resource. Although listed, the eligibility criteria are not given, which is not unusual for early NRHP nominations. However, its primary significance is as one of the last remaining sacred places of the Pawnee in Nebraska and Kansas, and while the Pawnee now live in Oklahoma, tribal members still travel to Nebraska and visit their ancestral homeland. Pahuk Hill, while not formally designated as such, meets the criteria for recognition as a TCP. (Steinuer, 2011)

3.8.13.3 Federally Recognized Tribes

There are eight federally recognized tribes that maintain a physical presence in Region VII. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes by region.

[51] Carnegie Libraries were constructed using donations from philanthropist Andrew Carnegie. From 1886 to 1919, over $40M in donations opened 1,679 library buildings across America. (NPS, 2017)

3.8.13.4 Federal Lands

Missouri has the largest portion of federally owned lands in Region VII among the major Federal landholders. Mark Twain National Forest, in the southern half of the State, covers more than 1.4 million acres across 29 counties (USFS, 2012). Table 3-32 lists acreage by landholder for the five major Federal land managing agencies in Region VII.

Table 3-32: Federal Land Ownership in Acres, Region VII

	Iowa	Kansas	Missouri	Nebraska	Total for Region VII
USFS	None	108,176	1,492,596	352,463	**1,953,235**
NPS	2,708	461	54,382	5,650	**63,201**
USFWS	70,564	29,509	59,977	173,614	**333,664**
BLM	None	None	None	6,354	**6,354**
DOD	49,331	163,011	68,445	11,265	**292,052**
Total By State	**122,603**	**301,157**	**1,675,400**	**549,346**	**2,648,506**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.14 Existing Conditions—FEMA Region VIII

FEMA Region VIII includes parts of the Upper Midwest and the Rocky Mountain region, and features a mix of historic properties ranging from settler-related resources to urban neighborhoods. The Knife River Indian Villages National Historic Site, ND preserves the history of the Northern Plains Indians trade and agriculture, and the Curtis-Champa Streets Historic District in Denver, CO contains well-preserved examples of residential Italianate architecture.

3.8.14.1 Historic Properties

The historic properties in Region VIII include prehistoric and historic archaeological sites and historic above-ground properties. Buffalo traps, medicine wheels, lodges, rock shelters, and cliff dwellings are some of the prehistoric archaeological site types found in the region. Historic archaeological site types include trading posts, stagecoach stations, trails, ranches, railroad depots, and forts. Some of the above-ground historic property types in Region VIII are National Park lodges, grain elevators, oil derricks, farms, commercial blocks, and religious buildings. Historic architectural types in the region include cabins, front gabled, hall and parlor, ranches, and Victorian. Historic architectural styles including Classical Revival, Gothic Revival, Queen Anne, Romanesque Revival, and Rustic, are found throughout the region as well. Unique examples of historic properties in the region are the Topaz War Relocation Center, a World War II-era Internment Camp in Millard County, UT; Yucca Theater in Treasure County, MT; and the Wounded Knee Battlefield, on the Pine Ridge Indian Reservation, SD. Table 3-33 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-33: Distribution of Listed Historic Properties, Region VIII

	Colorado	Montana	North Dakota	South Dakota	Utah	Wyoming	Total for Region VIII
National Register Properties	1,477	1,135	433	1,302	1,544	534	**6,425**
National Historic Landmarks	25	28	6	16	14	25	**114**

Source: (NPS, 2015h)

3.8.14.2 Traditional Cultural Properties

A notable TCP in Region VIII is the Medicine Wheel/Medicine Mountain National Historic Monument in Wyoming, which for centuries has been used by Crow youth for fasting and vision quests. The site, formerly known as Bighorn Medicine Wheel and estimated to be more than 700 years old, is also used for prayers of thanks, healing, and atonement for harm done to the Earth and others. (Stanford SOLAR Center, 2008)

3.8.14.3 Federally Recognized Tribes

There are 30 federally recognized tribes that maintain a physical presence in Region VIII. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes by region.

3.8.14.4 Federal Lands

Consistent with the pattern of increasing acreage of public lands in the western half of the United States, the amount of federally owned lands in Region VIII far exceeds that in any of the eastern or central regions. The largest landholder in the region is the BLM, and the State with the greatest acreage of Federal lands is Utah. Table 3-34 lists acreage by landholder for the five major Federal land managing agencies in Region VIII.

Table 3-34: Federal Land Ownership in Acres, Region VIII

	Colorado	Montana	North Dakota	South Dakota	Utah	Wyoming	Total for Region VIII
USFS	14,520,965	17,082,821	1,106,034	2,017,435	8,207,415	9,241,610	**52,176,280**
NPS	609,880	1,214,184	71,250	141,312	2,097,106	2,344,852	**6,478,584**
USFWS	173,265	635,066	484,681	205,128	107,885	70,674	**1,676,699**
BLM	8,332,001	7,981,452	58,841	274,437	22,854,937	18,370,351	**57,872,019**
DOD	449,964	8,338	14,950	7,929	1,766,260	16,025	**2,263,466**
Total By State	**24,086,075**	**26,921,861**	**1,735,756**	**2,646,241**	**35,033,603**	**30,043,512**	**120,467,048**

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.15 Existing Conditions—FEMA Region IX

FEMA Region IX includes a mix of historic properties ranging from Native American sites to urban areas to World War II battlefields. The Casa Grande Ruins National Monument in Arizona preserves the ruins of 13th century Native American structures; the Bungalow Heaven Historic District in Pasadena, CA, contains over 800 Craftsman-style homes from the early 1900s; and the Marshall Islands contain two NRHP-listed World War II Battlefields.

3.8.15.1 Historic Properties

The historic properties in Region IX vary from prehistoric archaeological sites like petroglyphs and cliff dwellings to historic archaeological sites including shipwrecks and missions. Some of the above-ground historic properties in the region are post offices, railroads, commercial blocks, Carnegie libraries, and dams. Architectural types in the region range from bungalows, ranch houses, and missions in the southwestern States, to military facilities and meetinghouses in the Pacific. Styles include Art Deco American Craftsman, Colonial Revival, Mission Revival, Pueblo Revival, Spanish Colonial, Queen Anne, and Japanese Colonial. Notable historic properties in the Region vary and include the Newspaper Rock Petroglyphs Archaeological District, AZ; United States Naval Station Tutuila Historic District, American Samoa; and the Hearst Castle in San Simeon, CA. Table 3-35 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-35: Distribution of Listed Historic Properties, Region IX

	Arizona	California	Hawaii	Nevada	Pacific Island Territories	Total for Region IX
National Register Properties	1,423	2,653	343	375	196	**4,990**
National Historic Landmarks	45	145	33	8	8	**239**

Source: (NPS, 2015h)

3.8.15.2 Traditional Cultural Properties

One TCP identified in Region IX is Po'ohilo, on the Hawaiian island of Oahu. It is the site of a battle in which chiefs from Hawaii and Maui invaded Oahu during the reign of Mailikukahi. It was significant both for the ferocity of the battle and for the fact that it was the first time Oahu chiefs defeated chiefs from Hawaii and Maui. (Honolulu Authority for Rapid Transportation, 2012)

3.8.15.3 Federally Recognized Tribes

There are 150 federally recognized tribes with a physical presence in Region IX, 109 of which are in California. In accordance with 36 C.F.R. § 800 implementing Section 106 of NHPA, Federal agencies have the same responsibility to consult with the 88 Native Hawaiian Organizations as they do federally recognized Indian Tribes regarding any historic property that may be affected by a Federal undertaking and for which a Native Hawaiian Organization attaches religious and cultural significance. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes in Region IX.

3.8.15.4 Federal Lands

Nevada has the greatest amount of federally owned land in Region IX, the vast majority of which is owned by BLM, which is also the dominant landholder in the region as a whole. Table 3-36 lists acreage by landholder for the five major Federal land managing agencies in Region IX. Data were not available regarding acreage of Federal lands in the Pacific Island territories.

Table 3-36: Federal Land Ownership in Acres, Region IX

	Arizona	California	Hawaii	Nevada	Guam	American Samoa	Northern Mariana Islands	Total for Region IX
USFS	11,264,619	20,821,541	1	5,764,262	None	None	None	**37,850,423**
NPS	2,618,735	7,570,527	357,772	774,751	958	None	None	**11,322,743**
USFWS	1,683,269	286,664	298,980*	2,335,400	23,228	None	None	**4,627,541**
BLM	12,203,495	15,306,243	None	47,805,923	None	None	None	**75,315,661**
DOD	2,971,169	3,812,558	177,033	281,442	62,748	18	5	**7,304,973**
Total By State	**30,741,287**	**47,797,533**	**833,786**	**56,961,778**	**86,934**	**18**	**5**	**136,421,341**

*Hawaii FWS does not include the Papahanaumokuakea Marine National Monument (88,647,881 acres).

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.8.16 Existing Conditions—FEMA Region X

FEMA Region X encompasses the Pacific Northwest and Alaska, and has a mix of cultural resources, including Native Alaskan sites and urban neighborhoods. Archaeological sites associated with 19th century Asian laborers exist in Washington; the NHL-designated Ipiutak Site in Alaska preserves the remains of Inuit culture; and the Bonneville Dam on the Columbia River in Oregon is listed in the NRHP as a historic district.

3.8.16.1 Historic Properties

The historic property types in Region X include prehistoric archaeological sites like rock shelters, petroglyphs, mounds, and shell middens. Some of the historic archaeological site types in the region are mining sites, forts, cabins, and grist mills. Typical above-ground historic properties include courthouses, schools, farms, railroads, and churches. Examples of historic architectural types in Region X include bungalows, cabins, and Russian Orthodox churches. Historic architectural styles include Art Deco, Craftsman, Gothic Revival, Romanesque Revival, and Rustic. A unique example of a historic property in the region is Chief Son-I-Hat's Whale House and Totems Historic District in Alaska. Additional exceptional examples are St. Philip's Episcopal Church in Wrangell, AK, and the Hells Canyon Archaeological District in Lewiston, ID (NPS, 2013b), (NPS, 2013c). Table 3-37 shows the distribution of NRHP-listed properties and NHLs in the region.

Table 3-37: Distribution of Listed Historic Properties, Region X

	Alaska	Idaho	Oregon	Washington	Total for Region X
National Register Properties	423	1,027	1,985	1,498	**4,933**
National Historic Landmarks	49	10	17	24	**100**

Source: (NPS, 2015h)

3.8.16.2 Traditional Cultural Properties

An example of a TCP in the Region is Snoqualmie Falls in Washington, which is significant for its association with the beliefs of the Snoqualmie people. (NRHP, 2010)

3.8.16.3 Federally Recognized Tribes

There are 265 federally recognized tribes that maintain a physical presence within Region X, 229 of which are Alaska Natives. Section 106 of the NHPA requires consultation with any tribe who may have an interest in a project, regardless of whether the project is proposed on tribal land. Refer to Appendix D for a list of federally recognized tribes by region.

3.8.16.4 Federal Lands

Region X contains more federally owned lands than any other region, with a total of more than 300 million acres. The majority of Federal lands in the region are in Alaska, with more than 225 million acres, an area larger than Texas. Table 3-38 lists acreage by landholder for the five major Federal land managing agencies in Region X.

Table 3-38: Federal Land Ownership in Acres, Region X

	Alaska	Idaho	Oregon	Washington	Total for Region X
USFS	21,956,250	20,465,014	15,687,556	9,289,102	**67,397,922**
NPS	52,620,514	507,585	192,020	1,833,697	**55,153,816**
USFWS	76,626,272	48,947	574,510	181,693*	**77,431,422**
BLM	72,958,757	11,610,111	16,134,191	429,156	**101,132,215**
DOD	1,686,371	4,178	77,153	440,166	**2,207,868**
Total By State	**225,848,164**	**32,635,835**	**32,665,430**	**12,173,814**	**303,323,243**

*Washington FWS includes Hanford Reach National Monument (32,965 acres) administered by FWS but not as part of the National Wildlife Refuge System.

Source: (Gorte, Vincent, Hanson, & Rosenblum, 2012)

3.9 AESTHETICS/VISUAL RESOURCES

Unit of Analysis
USGS Physiographic Regions

3.9.1 Definition of the Resource

Aesthetics/visual resources are the observable physical features of a landscape (e.g., land, water, vegetation, animals, and structures) that make up the visual quality, character, or setting of an area. The landscape features that define an area of high visual quality may be natural (e.g., mountain views) or man-made (e.g., a city skyline).

The term *aesthetics* refers to the pleasurable characteristics of a physical environment as perceived through the five senses of sight, sound, smell, taste, and touch (BLM, 2010). When evaluating visual resources, aesthetics refers to the beauty or attractiveness of a scene as perceived through the sense of sight. Scenic (or visual) quality is the relative worth of a landscape from a visual perception point of view (BLM, 2010) (i.e., a way of assigning aesthetic value to visual resources). The terms "visual resource management," "visual quality," and "scenery management," are often used when discussing land or scenery management, while the term "aesthetics" is more often used when talking about urban design or landscape architecture.

This section provides an overview of the following types of aesthetic/visual resources: (1) Scenic Byways; (2) National Parks; (3) Wild and Scenic Rivers; (4) Wilderness Areas; and (5) State, Local and Community Parks. Consideration of aesthetics/visual resources in this NPEIS is needed given that NFIP actions may impact a variety of settings and landscapes. The unit of analysis for this section, USGS Physiographic Regions, was selected to group aesthetics/visual resources by geographic areas that possess similar geologic/physical characteristics. Refer to Section 3.1.2 for a more detailed discussion of USGS physiographic regions.

3.9.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. There are no Federal laws or regulations related to visual resource, although a number of laws and regulations highlight the protection of scenic resources, such as the NHPA and the Wild and Scenic Rivers Act. Appendix A provides descriptions of these laws and regulations.

3.9.3 Existing Conditions—Nationwide

Many of the most scenic areas in the country have been set aside for scenic resource protection in the form of scenic byways, national parks, Wild and Scenic Rivers, and wilderness areas. These special areas are more sensitive to changes in landforms and scenery. Additionally, adjacent areas often are included as part of the viewshed[52] of these areas. Therefore, changes in adjacent areas can also impact these scenic National treasures. In addition to national designations, States, counties, cities, and nearly all local communities designate parks and natural areas to be managed in part for their aesthetic qualities. Community parks and other aesthetically pleasing areas are often adjacent to coasts or waterways, which provide natural greenspace and high quality visual resources, along with related recreation opportunities such as beaches and wooded riparian settings.

Due to the vast size and varied landscape of the United States, this report cannot describe all of the scenic resources along the nation's waterways and coasts that lie within flood-prone areas. Instead, this section will provide a broad overview of typical scenery along waterways and coasts within physiographic regions, which are landform descriptions used by the USGS (USGS, 2013i), as described and delineated by Nevin Fenneman (USGS, 2013a). The BLM uses physiographic regions as a key component of the scenic quality evaluation process in their Visual Resource Management system (BLM, 2005a). General descriptions of the types of scenery within each physiographic region can be found in Section 3.9.5 and in relation to specific FEMA Regions in Section 3.9.6.

3.9.4 Notable Scenic Resources in the United States

3.9.4.1 Scenic Byways

America's Byway System consists of 150 distinct and diverse roads designated by the United States Secretary of Transportation. America's Byways include National Scenic Byways and All-American

[52] Viewshed: The natural and manmade environment visible from one or more viewing points.

Roads (FHWA, 2013a). Many of these roads wind through coastal regions and along rivers containing some of the most scenic landscapes in the United States.

3.9.4.2 National Parks

The NPS within the Department of the Interior manages 401 national parks, approximately 27,000 historic structures, 2,461 National Historic Landmarks, 582 National Natural Landmarks, and 49 National Heritage Areas. Within these areas, the NPS manages over 85,000 miles of perennial rivers and streams and over 43,000 miles of shoreline (NPS, 2013e). Whether designated for cultural, social, or visual quality reasons, all of these areas are highly sensitive to landscape change and visual resource contrast.

3.9.4.3 Wild and Scenic Rivers

The National Wild and Scenic Rivers System was created by Congress in 1968 (Public Law 90-542; 16 U.S.C. § 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations (Haas, 2013). Under this system, rivers can be designated as "wild," "scenic," or "recreational." "Scenic" rivers, in particular, are set aside for their aesthetic and scenic values, and have high quality and highly sensitive visual resource values. The National Wild and Scenic Rivers System protects 12,000 miles of more than 200 rivers in the United States, which are about 0.25 percent of the Nation's rivers. By comparison, more than 75,000 large dams across the country have modified at least 600,000 miles, or about 17 percent, of American rivers (Haas, 2013). Areas designated as "wild" or "scenic" must remain free of such impoundments.

3.9.4.4 Wilderness Areas

Congress enacted the Wilderness Act of 1964 (Public Law 88-577 [16 U.S.C. §§1131-1136]) to "… establish a National Wilderness Preservation System for the permanent good of the whole people, and for other purposes." Among those purposes, the Wilderness Act lists "scenic value." The National Wilderness Preservation System includes over 100 million acres across the country, which is about 5 percent of the land area (University of Montana, 2013). Because these areas are preserved in a natural State, without roads or buildings, many of these areas have intrinsic natural beauty, creating increased sensitivity toward landscape change on adjacent lands.

3.9.4.5 State, Local, and Community Parks

The 50 United States collectively contain over 7,800 State parks, receiving a combined annual visitation of more than 720 million people (America's State Parks, 2014). State parks are often set aside for visual resource values and, along with national parks, make up the park system of the United States. Of the thousands of municipalities and townships across the country, most have some area or areas designated as public green space. These local and community parks typically exhibit natural scenery and man-made aesthetic resources. Often, such parks are built alongside water features, such as coasts, lakes, rivers, creeks, and streams to provide natural settings within the human environment.

3.9.5 Existing Conditions—Physiographic Regions

The United States can be divided into eight distinct geologic regions within the conterminous United States, with Alaska and Hawaii accounted separately. These eight regions can be further subdivided into

25 provinces, each with unique types of topography and scenery (USGS, 2013i). The waterways and coastal regions of the United States have distinct features (e.g., topography and vegetation) within these regions and provinces, which relate to the type of scenery that can be found in each. Figure 3-2 shows the physiographic regions as compared with FEMA's administrative regions. The following sections provide a description of the eight physiographic regions plus Alaska and Hawaii.

3.9.5.1 Laurentian Highlands

The Laurentian Highlands of the Canadian Shield extend into Wisconsin and Minnesota in the Great Lakes region of the United States. The single province in this region that can be found in the United States is the Superior Upland (USGS, 2013i). This region consists of relatively flat upland plains, gentle rolling hills, and arboreal forests. Many streams and lakes meander through the mostly wooded terrain. Small cities and towns are found mostly along the waterways and larger lakes. The rural atmosphere of the region provides many natural vistas. A number of State parks, national parks, national forests, and designated wilderness areas are found within this region.

3.9.5.2 Atlantic Plain

This region consists of both the underwater Continental Shelf and the Coastal Plain Province. The coastal plain gently slopes up from the ocean, westward toward the Appalachian Mountains along the eastern seaboard, running south from the coastal tip of New York, down through Florida and west through the Gulf States (USGS, 2013i). The Atlantic Plain region extends along the coastal plains and is generally very wet, including thick deciduous forests, and rivers, marshes, swamps, and wetlands. As one of the most densely populated portions of the United States, many large cities and small towns are situated throughout the region, many of which sit along the coast and along the waterways. The scenery includes many historic places, such as battlefields and historic buildings. The area also contains State and national parks, as well as many scenic byways.

3.9.5.3 Appalachian Highlands

This region includes the Piedmont, Blue Ridge, Valley and Ridge, St. Lawrence Valley, Appalachian Plateaus, New England, and Adirondack Provinces. This region follows the long chain of ridges and valleys that make up the Appalachian Mountains, from northeastern Alabama all the way to Maine (USGS, 2013i). Rivers, streams, and lakes are situated throughout the region. Much of the region is blanketed with deciduous forests that attract outdoor recreation and scenic tourism, especially in the fall when the leaves change colors. Much of the area is rural, including wilderness, refuges, national parks, scenic byways, and other designations that preserve natural characteristics of the landscape.

3.9.5.4 Interior Plains

The Interior Plains region covers much of the central United States, spanning areas from eastern Montana, Wyoming, and Colorado, eastward to western portions of Ohio, Kentucky, and Tennessee. This region contains the Interior Low Plateaus, the Central Lowland, and the Great Plains (USGS, 2013i). This physiographic region consists of relatively flat topography of gentle rolling hills and flatlands covered mostly with grasses and low shrubs. Several major rivers flow out of the Rocky and Appalachian Mountains, forming long, wide rivers such as the Mississippi and Missouri Rivers, which meander through the grasslands toward the Gulf of Mexico. The largest population centers are based along these rivers. Within the Interior Low Plateaus, the topography becomes more diverse, including some steeper, rugged areas. This area contains fewer national parks and scenic byways than the other regions of the United States, due to the lack of scenic diversity.

3.9.5.5 Interior Highlands

This relatively small region consists of the Ozark Plateaus and the Ouachita Provinces in Missouri, Arkansas, and Oklahoma. These mountainous regions are the only notable highlands between the Rocky and Appalachian Mountains (USGS, 2013i). These mixed deciduous, forested mountains contain three National Forests and numerous lakes and rivers. The ruggedness of the area has limited the number of towns in the region, while the natural and wild beauty of the area has made it a popular place for recreation and scenic touring.

3.9.5.6 Rocky Mountain System

This region consists of the Southern, Middle, and Northern Rocky Mountains and the Wyoming Basin Provinces and includes portions of Colorado, Wyoming, Utah, Idaho, and Montana (USGS, 2013i). Although separated by Canada, the Rocky Mountain System Region continues north into Alaska. The Rocky Mountains include the tallest, youngest mountains in the country. Visual resources include many tall peaks and ridges, deep valleys and canyons, and a variety of other landforms, such as plateaus, mesas, and basins. Because of the topographic relief, vegetation in the region can vary from sparse desert landscapes to thick forests to grasslands and tundra. Much of the area is preserved as national parks, national forests, wilderness areas, and Wild and Scenic Rivers. Mountain resort towns, scenic roads, and other tourist attractions exist throughout the region.

3.9.5.7 Intermontane Plateaus

This region consists of the Basin and Range, Colorado Plateau, and Columbia Plateau Provinces, including portions of New Mexico, Arizona, California, Nevada, Utah, Idaho, Oregon, and Washington (USGS, 2013i). The Intermontane Plateaus is the most topographically diverse of the eight physiographic regions. The region contains vast, flat deserts with sparse vegetation and salt flats; long, steep mountain ranges; massive cliffs and escarpments; and deep narrow canyons, ravines, gorges, arches, and slot canyons. The processes of erosion showcase extensive geologic history in the strata of the Colorado Plateau. Many national parks, national recreation areas, scenic byways, and Wild and Scenic Rivers are protected within this region. Cities and towns can be found in many of the low-lying valleys and the more fertile areas.

3.9.5.8 Pacific Mountain System

This region contains the Cascade-Sierra Mountains, Pacific Border, and the Lower California Provinces. The Cascade and Sierra mountain ranges extend through California, Oregon, and Washington, containing high peaks and active volcanoes. These jagged mountains descend thousands of feet into the Pacific. Many smaller mountains and coastal plains are found within the Pacific Border Province. The region showcases many unique land and vegetation features. The coast varies from steep, rocky terrain to sandy beaches. Scenic resources include many national parks, national recreation areas, scenic byways, and

Wild and Scenic rivers. These protected areas are home to some outstanding visual resources in the country, such as the world's largest and tallest trees (California redwoods), the deepest lake in North America (Crater Lake in Oregon), and others.

3.9.5.9 Alaska

Alaska is a unique physiographic region consisting of 12 different provinces, including landforms such as coastal plains, troughs, peninsulas, foothills, and mountains (BLM, 2005a). The Rocky Mountain System extends into much of the interior of the State, with Intermontane Plateaus scattered between mountain ranges. Coastal plains exist along much of the northeastern parts of the State. Visual resources are striking and mostly natural, with few human settlements. Tall, jagged peaks, thick boreal forests, and vast grasslands contribute the bulk of the visual resources. Visual resources are protected and preserved by many national parks, State parks, Wild and Scenic rivers, scenic roads, and preserves.

3.9.5.10 Hawaii

The physiography of the Hawaiian Islands includes massive volcanic shields and cinderlands, tall sea cliffs, coral plains, ridges, and valleys. The tropical climate adds a thick canopy of vegetation to most of the low-lying areas. Because of the contrast between the tall, jagged volcanic mountains and the tropical beach paradise, the Hawaiian Islands have become one of the most well-known resort locations in the world. Visual resources are protected and preserved by many national parks, State parks, and preserves.

3.9.6 Existing Conditions—FEMA Regions

3.9.6.1 FEMA Region I

Region I is characterized by the Appalachian Highlands physiographic region and contains a relatively small number of scenic resources. Of note is the Acadia National Park, ME, which was established as Lafayette National Park in 1919 and renamed Acadia in 1929 (NPS, 2013f). The Connecticut River Byway is another significant resource in the region, extending through Massachusetts, New Hampshire, and Vermont (FHWA, Undated). In addition, there are almost 240,000 acres of wilderness areas in central Vermont and eastern New Hampshire (University of Montana, Undated(a)). Table 3-39 shows the distribution of notable scenic areas in Region I.

Table 3-39: Notable Scenic Areas in FEMA Region I

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Connecticut	2	1	0	0 (0)
Maine	4	1	1	3 (18,625)
Massachusetts	1	3	0	1 (3,244)
New Hampshire	3	2	0	5 (138,618)
Rhode Island	0	0	0	0 (0)
Vermont	1	0	0	8 (101,019)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.2 FEMA Region II

Region II is characterized by the Atlantic Plain and Appalachian Highlands physiographic regions. There are a number of notable scenic resources in the area, including the Delaware River. The Delaware River is classified as a Wild and Scenic River and flows through New York and New Jersey (USFWS, 2013e). The Virgin Islands National Park covers approximately 60 percent of the island of St. John and almost all of Hassel Island; it contains a tropical rainforest and is known for its scuba diving (NPS, 2013d). The Mohawk Towpath Byway, NY, a Scenic Byway, follows the State's historic canal system, and is the only water-level route through the Appalachian Mountains (FHWA, Undated). Table 3-40 shows the distribution of notable scenic areas in Region II.

Table 3-40: Notable Scenic Areas in FEMA Region II

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
New Jersey	2	5	0	2 (10,341)
New York	3	1	0	1 (1,380)
Puerto Rico	0	3	0	1 (10,000)
USVI	0	0	1	0 (0)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.3 FEMA Region III

Region III is characterized by the Atlantic Plain and Appalachian Highlands physiographic regions. The only national park in the region is Shenandoah National Park. However, there are several important scenic resources, such as the National Mall and other National Monuments and historic sites in Washington, DC and the surrounding area. This region includes more than 240,000 acres of wilderness areas among Virginia, West Virginia, and Pennsylvania. Other scenic resources include the designated Wild and Scenic Rivers of upper Delaware River and the Allegheny River, PA and White Clay Creek, DE. The Journey Through Hallowed Ground Byway, a 180-mile corridor through Maryland, Virginia, and Pennsylvania holds numerous sites associated with the Revolutionary and Civil Wars. Table 3-41 shows the distribution of notable scenic areas in Region III.

Table 3-41: Notable Scenic Areas in FEMA Region III

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (Acres)
Delaware	1	1	0	0 (0)
District of Columbia	0	0	0	0 (0)
Maryland	6	0	0	0 (0)
Pennsylvania	3	6	0	2 (9,002)
Virginia	5	0	1	24 (214,904)
West Virginia	6	1	0	9 (18,810)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.4 FEMA Region IV

Region IV is characterized by the Atlantic Plain and Appalachian Highlands physiographic regions. There are extensive scenic resources in this region, including more than 2.2 million acres of wilderness areas, 1.4 million of which are in Florida. The Everglades National Park in southern Florida is the largest subtropical wilderness and the 3rd largest park in the continental United States, receiving more than 1 million visitors annually (NPS, 2013h). The Great Smoky Mountain National Park, which straddles the ridgeline of the Great Smoky Mountains, extends through parts of North Carolina and Tennessee. The Great Smoky Mountain National Park is a UNESCO World Heritage Site, and is the most visited national park in the United States (NPS, 2013i). The Natchez Trace Parkway is a Scenic Byway that extends through Alabama, Mississippi, and Tennessee and affords views from forests and cypress swamps to cotton fields in the countryside (FHWA, Undated). Table 3-42 shows the distribution of notable scenic areas in Region IV.

Table 3-42: Notable Scenic Areas in FEMA Region IV

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Alabama	4	1	0	3 (41,367)
Florida	6	2	3	17 (1,422,247)
Georgia	1	1	0	14 (486,530)
Kentucky	6	1	1	2 (18,132)
Mississippi	2	1	0	3 (10,126)
North Carolina	4	5	1	12 (111,419)
South Carolina	4	1	1	7 (60,681)
Tennessee	5	1	1	11 (66,349)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.5 FEMA Region V

Region V is characterized by the Appalachian Highlands, Interior Plains, and Laurentian Highlands physiographic regions; the United States portion of the Laurentian Highlands is completely contained within Region V. The region contains more than 1.2 million acres of wilderness areas, the majority of which are in Minnesota, such as the Boundary Waters Canoe Area Wilderness (University of Montana, Undated(a)). There are only three national parks in the region, including the Cuyahoga Valley National Park, OH, which was designated as a national park in 2000. There are a number of Wild and Scenic Rivers in the region, including the Sturgeon River, MI; St. Croix River, WI; and Big Darby Creek, OH (National Wild and Scenic Rivers System, 2013). Scenic byways in the region include the Ohio River Scenic Byway, which extends through Illinois, Indiana, and Ohio, and Route 66, which originates in Illinois. Table 3-43 shows the distribution of notable scenic areas in Region V.

Table 3-43: Notable Scenic Areas in FEMA Region V

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Illinois	7	1	0	8 (32,113)
Indiana	3	0	0	1 (12,463)
Michigan	3	16	1	15 (285,596)
Minnesota	8	1	1	3 (819,121)
Ohio	5	3	1	1 (77)
Wisconsin	1	5	0	7 (79,943)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.6 FEMA Region VI

Region VI is very aesthetically diverse. The region is characterized by five different physiographic regions: the Atlantic Plain, the Interior Plains, the Interior Highlands, the Rocky Mountain System, and the Intermontane Plateaus. New Mexico contains the vast majority of wilderness areas in the region, accounting for 1.6 million of the approximately 1.9 million acres. The Gila Wilderness, presently part of Gila National Forest in southwest New Mexico, was the world's first designated wilderness area in 1924 and has approximately 560,000 acres (University of Montana, Undated(b)). Also of note in the region is Big Bend National Park, TX, which at 801,163 acres contains the largest protected area of Chihuahuan Desert topography and ecology in the United States (Jameson, 2013). The Cherokee Hills Byway, along the foothills of the Ozark Mountains, OK, and the Talimena Scenic Drive that extends through Arkansas and Oklahoma, are two of the scenic byways in the region. The Saline Bayou, LA, and Little Missouri River, AR are two designated Wild and Scenic Rivers that represent some of the diversity found in the region. Table 3-44 shows the distribution of notable scenic areas in Region VI.

Table 3-44: Notable Scenic Areas in FEMA Region VI

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Arkansas	3	8	1	12 (153,655)
Louisiana	2	1	0	3 (17,025)
New Mexico	8	4	4	25 (1,650,596)
Oklahoma	4	0	0	3 (23,113)
Texas	0	1	1	6 (85,333)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.7 FEMA Region VII

Region VII is characterized by the Interior Plains and Interior Highlands physiographic regions. This region has the 2nd lowest wilderness area acreage in the country, behind Region II, with approximately 83,000 acres. This region does not contain any national parks. Missouri contains the majority of wilderness acreage in the region, distributed among several smaller areas. Other resources in the region include the Great River Road Scenic Byway, which follows the Mississippi River through Arkansas, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, and Wisconsin; and the

Flint Hills Scenic Byway that goes through the Great Plains grasslands of Kansas. The Eleven Point River, MO and the Niobrara River, NE are two Wild and Scenic Rivers that contribute to the aesthetic resources of the region. Table 3-45 shows the distribution of notable scenic areas in Region VII.

Table 3-45: Notable Scenic Areas in FEMA Region VII

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Iowa	2	0	0	0 (0)
Kansas	2	0	0	0 (0)
Missouri	2	1	0	8 (71,282)
Nebraska	0	2	0	2 (12,429)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.8 FEMA Region VIII

The Rocky Mountain System physiographic region, as well as the Interior Plains and Intermontane Plateaus dominate Region VIII. Western portions of the United States contain most of the country's wilderness, due to the high proportion of public lands. Region VIII has more than 12.4 million acres of designated wilderness. There are also many national parks, including five in Utah and four in Colorado. Many of the parks are internationally known, such as Zion and Arches National Parks, UT; Rocky Mountain National Park, CO; and Glacier National Park, MT. America's first national park and the most famous, Yellowstone, is also in Region VIII (NPS, 2013j). Other notable NPS units in the region include the vast Grand Staircase-Escalante National Monument, UT; Devils Tower National Monument, WY; and Mount Rushmore National Memorial, SD. Wild and Scenic Rivers are scarcer in the desert regions of the Intermontane Plateaus. Designated rivers include the Missouri River in both Montana and South Dakota and the Flathead in Montana. Utah and Colorado have the most National Scenic byways in the region, many of which twist around steep mountain roads and canyons. Other scenic treasures include Native American historic sites, such as Hovenweep or Canyon of the Ancients in Colorado. Table 3-46 shows the distribution of notable scenic areas in Region VIII.

Table 3-46: Notable Scenic Areas in FEMA Region VIII

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Colorado	11	1	4	43 (3,699,309)
Montana	1	2	2	15 (3,443,407)
North Dakota	2	0	1	3 (39,652)
South Dakota	2	1	2	2 (77,570)
Utah	8	1	5	33 (1,160,331)
Wyoming	1	2	2	15 (4,032,340)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.9 FEMA Region IX

The Intermontane Plateau, Pacific Mountain System, and Hawaii physiographic regions characterize Region IX. Travelling even further west, the number of designated wilderness units continues to increase with over 23 million acres, most of which are in California. There are also many national parks, including Yosemite, Death Valley, Sequoia, and Kings Canyon. The world's largest trees are found in Sequoia and Kings Canyon National Parks. The world's tallest trees are in Redwood National Park and State Parks, CA. Other important scenic national parks in the region include the Grand Canyon, Saguaro, and the Petrified Forest National Parks, AZ; Great Basin National Park, NV; Pacific Hawaii Volcanoes National Park, HI; and American Samoa National Park. Wild and Scenic Rivers for the region are found in California, such as the American River and portions of the Klamath River. National Scenic Byways include Route 66, which passes through Arizona; the Las Vegas Strip, NV; and Route 1 along the Pacific Coast, CA. Table 3-47 identifies the number of notable scenic areas in Region IX.

Table 3-47: Notable Scenic Areas in FEMA Region IX

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Arizona	5	2	3	90 (4,517,898)
California	7	16	8	149 (14,989,637)
Hawaii	0	0	2	2 (155,509)
Nevada	3	0	2	68 (3,372,418)
Pacific Island Territories	0	0	1	0 (0)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.9.6.10 FEMA Region X

The Rocky Mountain System, Intermontane Plateaus, Pacific Mountain System, and Alaska physiographic regions characterize Region X. Region X has about 69 million acres of wilderness, most of which can be found in Alaska; Alaska itself contains over half of the designated wilderness in the United States. The largest contiguous block of wilderness in the lower 48 States is also found in Region X at the Frank Church-River of No Return Wilderness, ID. There are eight national parks in Alaska, including Glacier Bay and the Kenai Fjords, famous for their glaciers, and spectacular mountain regions such as Denali, which contains North America's highest mountain, Mount McKinley. Other national parks in the region include Olympic and Mount Rainier, WA; and North America's deepest lake at Crater Lake National Park, OR. Scenic National Monuments include Mount St. Helens, WA and Craters of the Moon lava flows in Idaho. There are many Wild and Scenic Rivers designated in this area, such as the Snake and Salmon Rivers in Idaho and Oregon, Fortymile River in Alaska, the Skagit River in Washington, and nearly 50 different rivers in Oregon alone. National Scenic Byways include the Pacific Coast Highway, the Mountains to Sound Greenway near Seattle, the International Selkirk Loop in Idaho and Washington, the Northwest Passage of Lewis and Clark fame in Idaho, and several coastal and mountain roads in Alaska. Table 3-48 shows the distribution of notable scenic areas in Region X.

Table 3-48: Notable Scenic Areas in FEMA Region X

State	America's Byways	Wild and Scenic Rivers	National Parks	Wilderness Areas (acres)
Alaska	5	25	8	48 (57,425,992)
Idaho	6	24	1	12 (4,523,215)
Oregon	10	49	1	47 (2,474,435)
Washington	7	3	3	31 (4,462,822)

Sources: (FHWA, 2014) (Haas, 2013) (NPS, 2013g) (University of Montana, 2013)

3.10 INFRASTRUCTURE

Unit of Analysis
Nationwide

3.10.1 Definition of the Resource

Infrastructure is defined as public and private physical assets, including buildings; roads; bridges; railroads; airports; ports; dams; power grids; pipelines; communication facilities; public safety facilities (e.g., police, fire, hospitals); and utilities (e.g., water supply, sewer and solid waste management facilities). Consideration of these assets in this NPEIS is necessary given that they are distributed throughout every geographic area in the country, and often within floodplains. Each analyzed asset is essential to the Nation's security, public health and safety, economic vitality, and way of life.

Communities incorporate NFIP requirements into their zoning ordinances, which govern infrastructure development within the floodplain, specify building standards for construction in floodplains, and set regulations for residential areas under development. Utilities, including sanitary systems and wells, often must meet specific provisions for flood hazard areas. Local ordinances may include setbacks or buffers to protect stream banks and shorelines to preserve the natural functions of the channels and adjacent areas (FEMA, 2006b). Additional regulations may also restrict the siting of critical infrastructure facilities, such as hazardous waste facilities, nuclear power plants, sanitary landfills, hospitals, police, and fire stations.

States establish minimum regulatory requirements consistent with the NFIP requirements,[53] which include:

- Elevation of new and substantially improved residential structures above the base flood level;
- Elevation or dry floodproofing of new or substantially improved commercial structures;
- Prohibition of development in floodways, which are prone to deeper and faster moving water during flooding events; and
- Additional requirements to protect buildings in coastal areas from the impacts of waves, high velocity, and storm surge (FEMA, 2012b).

[53] Nineteen States/territories prohibit their agencies from engaging in floodway construction: AL, AZ, CA, CT, DC, HI, KY, MN, MT, NC, NH, NJ, NM, PA, PR, RI, SD, VA, WI. Twenty-two States/territories require that their bridge, culvert, and road projects be designed with no rise in water surface elevation from the base flood elevation: AL, AR, AZ, CA, CT, DC, DE, FL, HI, IL, IN, MA, MD, MS, NH, NM, NY, OH, OR, PA, RI, and WY. Thirteen States allow no more than a 1 ft increase: GA, KS, KY, LA, MN, ND, OK, PR, SC, SD, VA, WI, and WV. (FEMA, 2012b)

This section analyzes the following types of infrastructure: water control structures (including dams, levees, and pumping stations); transportation (including highways, railways, waterways, and airports); utilities (including energy infrastructure, water supply and wastewater infrastructure, non-hazardous solid waste infrastructure); and telecommunications. A nationwide unit of analysis was selected for this section; discussions center on each type of infrastructure and their respective distribution patterns throughout the country.

3.10.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. A discussion of the applicable laws and regulations for Infrastructure is provided below.

3.10.2.1 EO 11988 (Floodplain Management)

EO 11988, *Floodplain Management*, requires Federal agencies to "avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" and to use the 100-year flood as the base flood standard for the NFIP (FEMA, 2012a). Section 2(a) of the EO establishes an 8-step process that a Federal agency must conduct before project initiation to determine the potential impacts of an action on floodplains. Communities incorporate NFIP requirements into their zoning ordinances, which govern infrastructure development within the floodplain, specify building standards for construction in floodplains, and set regulations for residential areas under development.

3.10.2.2 EO 11990 (Protection of Wetlands)

EO 11990, *Protection of Wetlands*, requires Federal agencies to avoid the destruction or modification of wetlands, and to avoid direct or indirect support of development activities in wetlands if a practicable alternative is available. As with EO 11988, it requires Federal agencies to use the 100-year flood as the base flood standard for the NFIP. The EO established a process to determine the potential for impacts of an action on wetlands, analogous to the process established in EO 11988. Communities incorporate NFIP requirements into their zoning ordinances, which govern infrastructure development within the floodplain, specify building standards for construction in floodplains, and set regulations for residential areas under development.

3.10.3 Existing Conditions—Nationwide Infrastructure

3.10.3.1 Water Control Structures

Water control structures, such as dams and levees, attempt to manage floodwaters, protect land use and other infrastructure, and generate energy. In general, dams are built to control large volumes of water, while levees are designed to reduce the risk of flooding from certain stage flood events and are not constructed to hold back all floods. There are two types of dams: embankment dams (made primarily from soil, rock, or waste materials from mining operations) and concrete dams. Levees can include specific structures built to reduce the risk and the impact of flooding, such as earthen embankments covered in grass or gravel, or temporary emergency measures, such as sandbags. Other water control structures include canals, ditches, or subsurface drainage conduit (drain tile or tube), which provide control of the stage or discharge of surface and/or subsurface drainage. The management mechanisms on each structure may include flashboards, gates, valves, risers, or pipes.

There are several major water control operations throughout the country. In Florida, operations and maintenance staff with the South Florida Water Management District oversee approximately 2,000 miles of canals and 2,800 miles of levees/berms; nearly 70 pump stations; and more than 650 water control structures and 700 culverts. All of these structures and facilities are designed to protect regional water supplies and provide flood control (South Florida Water Management District, 2015). In California, the State Water Project is a water storage and delivery system consisting of 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 700 miles of open canals and pipelines. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in northern California, San Francisco Bay Area, San Joaquin Valley, Central Coast, and Southern California. Of the contracted water supply, 70 percent goes to urban users and 30 percent goes to agricultural users (California Department of Water Resources, 2010).

As development has increased within arid, flood-prone, and coastal regions, the need for water control structures has also increased. Millions of people throughout the United States depend on dams to create a water supply for agricultural and community use, provide recreation, supply hydroelectric power, and flood control, as well as levees to provide flood, storm, and hurricane protection (Figure 3-24). For instance, homes, farms, and communities in floodplains from Minnesota to Louisiana are threatened by potential overflow of the Mississippi and Missouri Rivers. Coastal communities are also vulnerable to rising tides during storm surges. (Medlock, 2010)

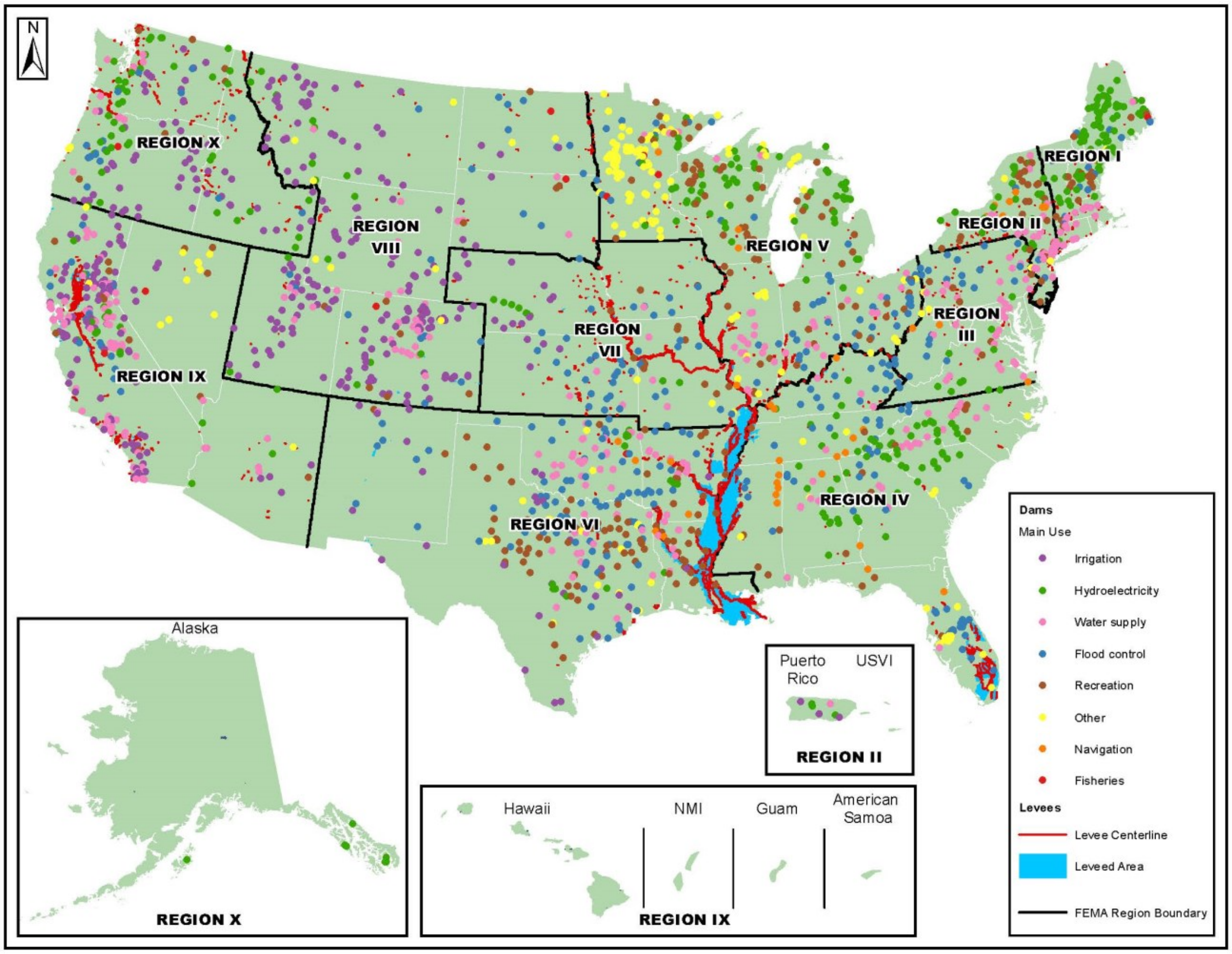
Many of the 84,000 total dams in the country were built as low-hazard dams to protect undeveloped, relatively low-value agricultural land. However, an increasing population and greater development has resulted in over 14,700 dams being classified as having a high-hazard potential, which is defined as the likelihood of losing one human life if the dam fails. Of these high-hazard dams, approximately 8,850 have an Emergency Action Plan (EAP) (USACE, Undated(a)). An EAP "identifies potential emergency conditions at a dam and specifies actions to be followed to minimize loss of life and property damage" (FEMA, 2013f). For example, within the State of California, 824 of the total 1,594 dams are considered high-hazard potential, with 235 having an EAP. Nebraska on the other hand has 130 high-hazard dams out of 2,835 total dams, with all but one dam having an EAP (USACE, Undated(a)). The Association of State Dam Safety Officials estimates that it will require approximately $21B to repair these aging, yet critical, high-hazard dams (American Society of Civil Engineers, 2013).

Almost two-thirds of the nation's 84,000 dams are privately owned, with only a few owned by the Federal government (National Flood Insurance Program, 2013). State dam safety programs regulate about 80 percent of the dams in the National Inventory of Dams. Currently, every State, with the exception of Alabama (and territory of Puerto Rico), has a dam safety program. Typically, these program activities include safety inspections of new and existing dams, and reviewing proposed dam construction projects and emergency plans (Association of State Dam Safety Officials, 2013). Additionally, the National Dam Safety Program, which is administered by FEMA, provides assistance to State dam safety programs, including grant funding, dam safety training, and research.

Based on information from the USACE, FEMA, and the State of California, the National Committee on Levee Safety has estimated that there are more than 100,000 miles of levees nationwide. As shown in Figure 3-24 levees are estimated to be in approximately 22 percent of the nation's counties and distributed across all 50 States (The National Committee on Levee Safety, 2011). Approximately 2,000 levee systems or more than 14,700 miles of levees are managed by the USACE. These levees are listed in the National Levee Database, which provides information on the location and condition of levees and floodwalls (USACE, 2013).

Overall, United States levee data are relatively coarse with uncertainty about the length and numbers of the levees, and the condition and flood protection capabilities of these structures. Levees were originally used to protect farmland from flooding, including coastal communities. However, now these structures are increasingly being used to protect developed communities. States, communities, and private levee owners are responsible for maintaining and operating their levees according to specific design criteria. Policies regarding levee design, construction, and maintenance vary between Federal and State agencies, and the responsibility for levee safety is often dispersed across different levels of government. The Association of State Dam Safety Officials and the Association of State Floodplain Managers has determined that 23 States have an agency with some responsibility for levee safety. (The National Committee on Levee Safety, 2011)

Of the more than 100,000 miles of levees nationwide, approximately 10 percent are monitored by the USACE. As of 2013, USACE inspection ratings of the USACE-monitored levees determined that 8 percent are in acceptable condition, while about 69 percent are minimally acceptable, and 22 percent are labeled as unacceptable. (USACE, 2013)



Sources: (Socioeconomic Data and Applications Center, 2011) (USACE, 2011a) (USACE, 2011b)

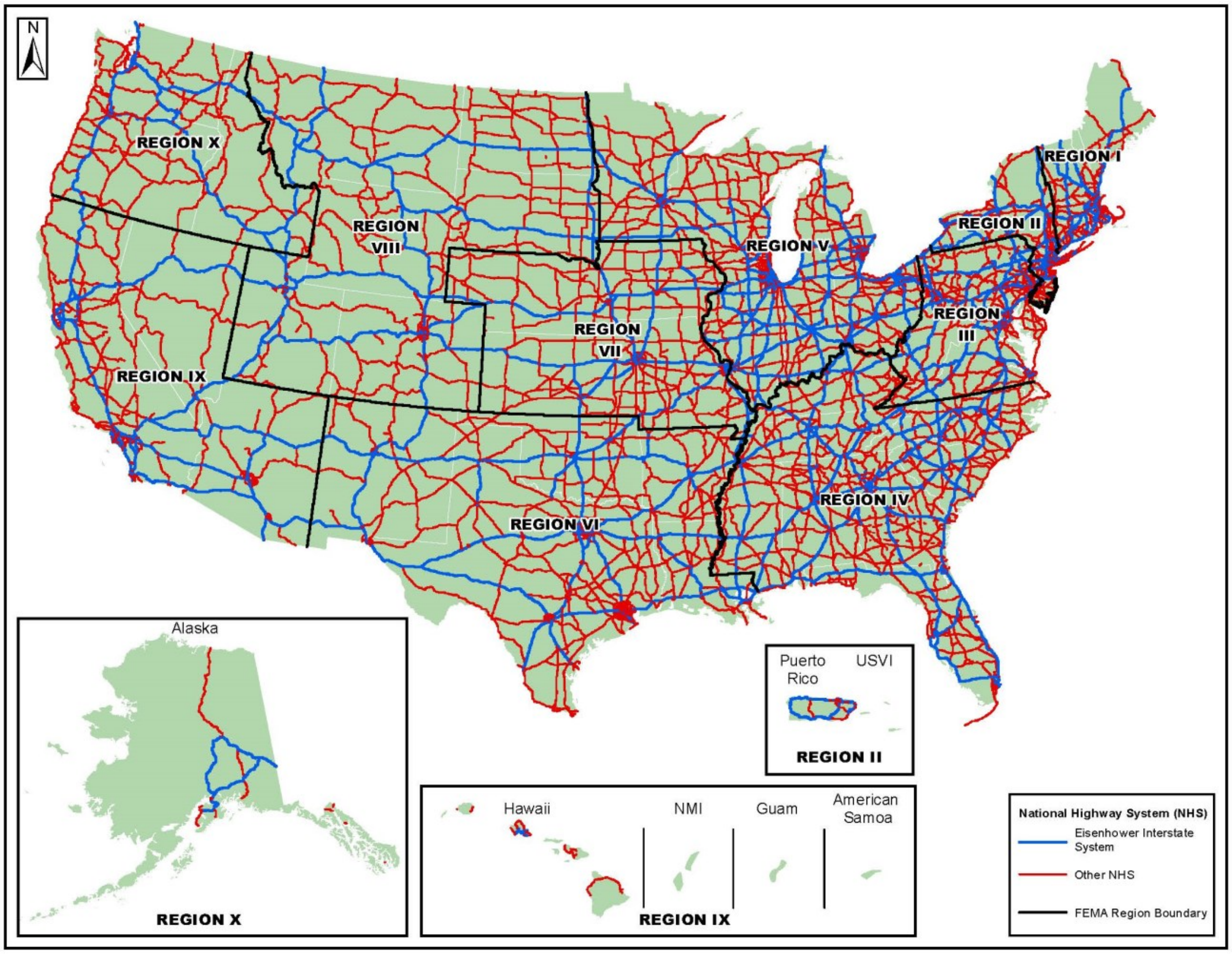
Figure 3-24: United States Dams and Levees Location Map

3.10.3.2 Transportation

Transportation infrastructure includes four major categories within the context of the NFIP NPEIS: highways, railways, waterways, and airports. Each infrastructure component is discussed in further detail within the subsections below.

State roads also contribute to the nation's interconnecting road network, which totals approximately 985,000 miles of federally funded highways (Figure 3-25) (FHWA, 2013b). The network also includes 607,380 bridges and 366 tunnels (NACE International, 2015) (FHWA, 2013c).

The Federal Highway Administration (FHWA), in conjunction with States and local communities, are improving the country's aging road network, specifically bridges nationwide. Of the nation's 607,380 bridges, 1 in 9 has been rated as structurally deficient. Twenty-two States have a higher percentage of structurally deficient bridges than the national average (11 percent), with Pennsylvania having slightly over 24 percent, followed by Iowa and Oklahoma at 21 percent. (American Society of Civil Engineers, 2013)



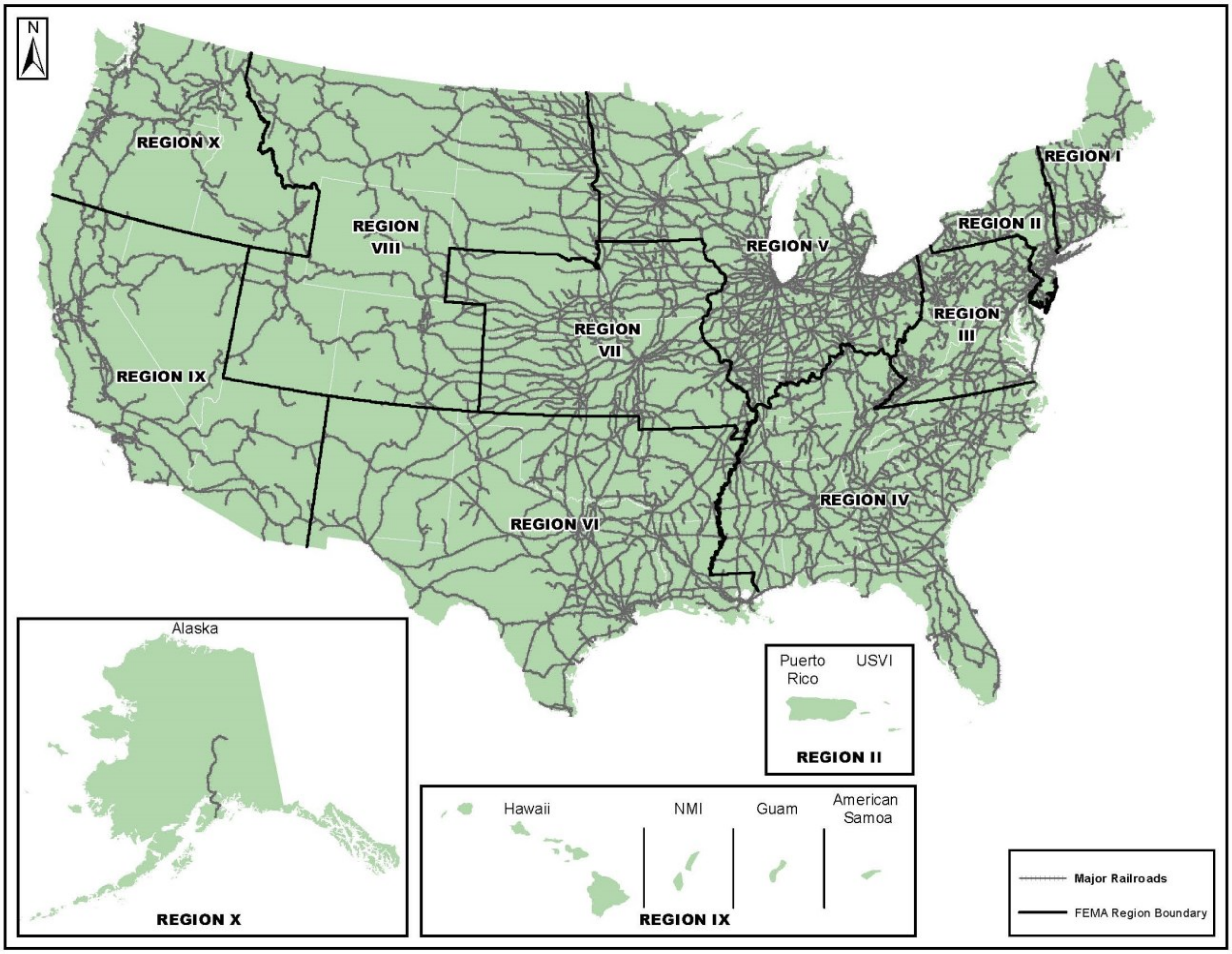
Source: (FHWA, 2011)

Figure 3-25: United States National Highway System Map

3.10.3.2.1 Railways

Another primary mode of transportation in the United States is the freight and transit railroad systems. As of January 2013, United States railroads operated approximately 138,500 miles of track throughout the country, including 21,300 miles used by Amtrak, as shown in Figure 3-26 (Association of American Railroads, 2013; Amtrak, 2013). The highest volume of freight train operations is in the Midwest, which includes FEMA Regions VII and VIII. The Gulf Coast region also has an extensive rail network, extending into the southern States, along the Mississippi River, and linkages to both the northwest and northeast. These railroads connect major ports in the Gulf Coast region, which serves as a critical junction for national freight movements, with New Orleans serving as a major interconnection between eastern and western railroads.

Due to the location of railroads in the coastal areas, the potential exposure of transportation infrastructure to flooding is immense, which could result in service disruptions extending outside the Gulf Coast Region (Gulf Coast Ecosystem Restoration Council, 2013). The busiest passenger transit rail system in the United States is in the northeast with routes between Washington, DC; New York City, NY; and Boston, MA (FEMA Regions I, II, and III). This rail system handles both Amtrak passengers and local commuters, with multiple routes throughout Connecticut and Massachusetts (Amtrak, 2011). Commuter rail systems are also in metropolitan areas across the country, including Chicago, IL; Philadelphia, PA; Salt Lake City, UT; and San Diego, Los Angeles, and San Francisco, CA. However, these commuter rail systems are contained within a limited geographic area.



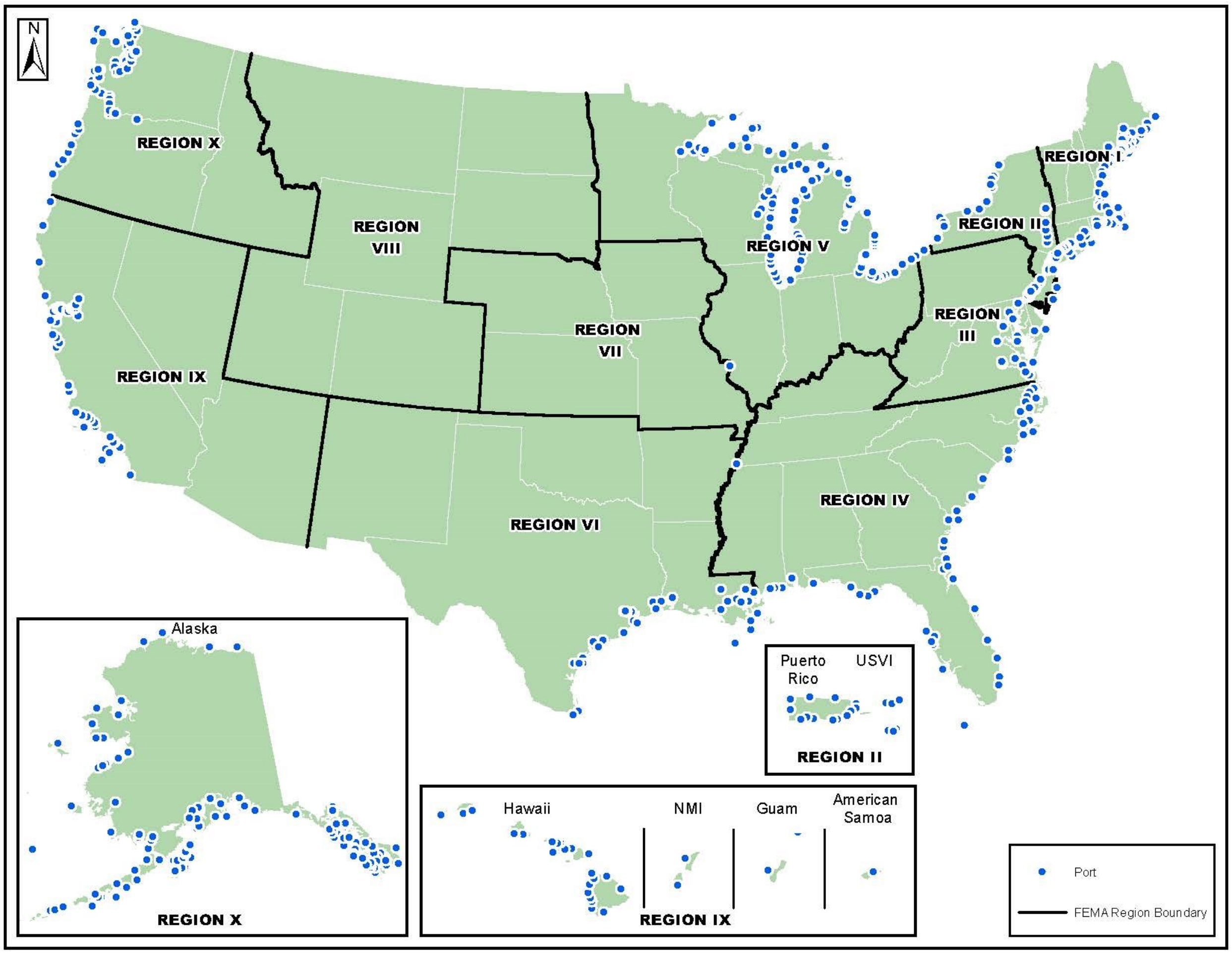
Source: (National Atlas of the United States, 2012b)

Figure 3-26: United States Railroad System Map

3.10.3.2.2 Waterways

The nation's port system, including seaports and inland waterways, is essential for domestic and international trade. Approximately 360 commercial sea and river ports are along the Atlantic, Pacific, Gulf, and Great Lakes coasts, as well as in Alaska, Hawaii, Puerto Rico, Guam, and USVI. There are also more than 150 seaports under the jurisdiction of State, local and county seaport agencies, navigation districts, and port authorities, as shown in Figure 3-27. According to the American Association of Port Authorities, United States ports and waterways handle more than 2 billion tons of domestic and import/export cargo annually. Nuclear and fossil fuel electric power plants also use waterways to transport fuel or cool power-plant equipment. (American Association of Port Authorities, 2013)

Ports and harbors support nearly all coastal resource uses through the transportation and delivery of personnel and goods to local and global markets, and to support exploitation of nearby living (e.g., fishing) and non-living (e.g., oil and gas) coastal resources. Approximately 346 million tons of goods were transferred from inland waterways to deepwater ports in 2010, primarily for export. In addition, it is estimated that more than 95 percent (by volume) of overseas trade produced or consumed in this country moves through our ports (American Society of Civil Engineers, 2013). The United States Armed Forces also use coastal resources to load and ship personnel and supplies. Several of the Pacific islands have military installations with active and reserve soldiers and their families.



Source: (National Geospatial Intelligence Agency, Undated)

Figure 3-27: United States Port System Map

Ports accommodate a variety of vessels, such as recreational watercraft, barges, ferries, and ocean-going cargo and passenger ships. For example, ferry operations are conducted at a number of large and small ports throughout the country, including the Port of Portland ME, the Port of Seattle, and Delaware River Port Authority. The Maine State Ferry Service offers daily ferry services (from May to October) between the mainland and island communities of North Haven, Vinalhaven, Matinicus Island, Swans Island, Frenchboro, and Islesboro (Maine Department of Transportation, 2013). The Port of Seattle offers several hundred ferry trips on a daily basis to nearby communities such as Bainbridge Island and Bremerton, and to distant locations such as Port Townsend, WA, and Sidney, BC (Canada) (Washington

State Department of Transportation, 2013). The Delaware Bay supports the world's largest freshwater port system, receiving more than 3,000 vessels per year. It is also the 2nd largest refining petrochemical center in the United States, receiving approximately 70 percent of the oil shipped to the East (Thank You Delaware Bay, 2012). The ports along the Gulf of Mexico from Texas to Florida include 11 of the top 20 ports for cargo movement in the United States.

Of the 25,000 miles of inland, intracoastal, and coastal waterways and channels in the United States, approximately 12,000 miles constitute the commercially active inland and Intracoastal Waterway system maintained by the USACE. The Mississippi River and its tributaries and the Gulf Intracoastal Waterway connect Gulf Coast ports, such as Mobile, New Orleans, Baton Rouge, Houston, and Corpus Christi, with major inland ports, including Memphis, St. Louis, Chicago, Minneapolis, Cincinnati, and Pittsburgh. In the Pacific Northwest, the Columbia-Snake River System allows navigation 465 miles inland to Lewiston, ID. The shippers and consumers in these States depend on the inland waterways to move about 630 million tons of cargo valued at over $73B annually. (USACE, Undated(b))

The northern half of the Atlantic Intracoastal Waterway (AIWW) along the East Coast includes a 3,000-mile shipping route along the Atlantic Ocean and Gulf of Mexico coasts in the southern and eastern United States (Figure 3-28). The federally maintained waterway connects sounds, bays, lagoons, rivers, and canals and is an alternative shipping route to ocean transportation and accompanying natural hazards. The required maintained (dredged) depth of the AIWW is 12 feet for use by commercial shippers, with the exception of the Dismal Swamp Canal, which is maintained to a depth of 6 feet, and therefore limited to recreational boaters (USACE, 2015). Other sections of the waterway are deeper and accessible to ocean-going vessels.

Source: (USACE, 2015)

Figure 3-28: AIWW

The Great Lakes Region is a major intermodal shipping region with economically important waterways to the Mississippi River and the Atlantic Ocean. The St. Lawrence Seaway, a joint effort by the United States and Canada to connect the Great Lakes to the Atlantic Ocean for shipping purposes, opened to navigation in 1959 with the Snell and Eisenhower Locks in Massena, NY. Today, the seaway generates $34.6B and employs 227,000 people. Major commodities shipped through the Great Lakes include iron ore, coal, limestone, agricultural products, and machinery (Great Lakes St. Lawrence Seaway System, 2015). The trek west from the St. Lawrence Seaway to the Duluth/Superior Harbor on Lake Huron takes 7 days, traveling through 16 locks and covering 2,342 miles. It is estimated that 100 ocean-going vessels per year make the round trip (University of Minnesota, 2014).

3.10.3.2.3 Airports

Similar to our country's port industry, the nation's airports also provide a means for transporting passengers and cargo both domestically and overseas. The five busiest United States airports are Atlanta, Chicago, Dallas-Ft. Worth, Denver, and Los Angeles. Five major airports in the New York metropolitan area create the largest and busiest airport system (The Port Authority of New York & New Jersey, 2013). Additionally, the majority of the United States airports are in the eastern half of the country and California.

A dozen major United States airports may be particularly vulnerable to storm surge flooding and sea level rise-related flooding risks. In October 2012, New York's LaGuardia Airport was severely impacted by Hurricane Sandy, which caused a storm surge of nearly 12 feet that overtopped the existing berm system, flooded parts of the facility, and damaged lighting and navigation systems. According to the National Climate Assessment Draft Report, 12 of the nation's largest airports have at least one runway with an elevation within 12 feet of current sea levels. In addition to the three airports in and around New York City, NY, the other vulnerable airfields include Philadelphia, PA; Washington, DC, Miami, FL; San Francisco and Oakland; Honolulu, HI; New Orleans, LA; and Tampa and Ft. Lauderdale, FL. San Francisco International Airport — the 7th largest United States airport by passenger volume — and Oakland International Airport were both built on land reclaimed from wetlands, and are approximately 10 feet above the current local sea level. One study indicates that there is a greater than 30 percent chance that the water level in Washington, DC, will exceed 8 feet above the average local high-tide line at least once by 2030, which would flood parts of Washington Ronald Reagan National Airport. The same study suggests that there is a 40 percent chance that the water level in Tampa, including the effects of a storm surge plus sea level rise, will top 5 feet above the average local high tide line at least once by 2030. That water level increase would flood part of the Tampa-St. Petersburg International Airport. Airports face critical challenges ahead, beginning with conducting risk assessments for long-lasting infrastructure, such as new terminals, runways, and maintenance facilities. (Climate Central, 2013)

3.10.3.3 Utilities

3.10.3.3.1 Energy Infrastructure

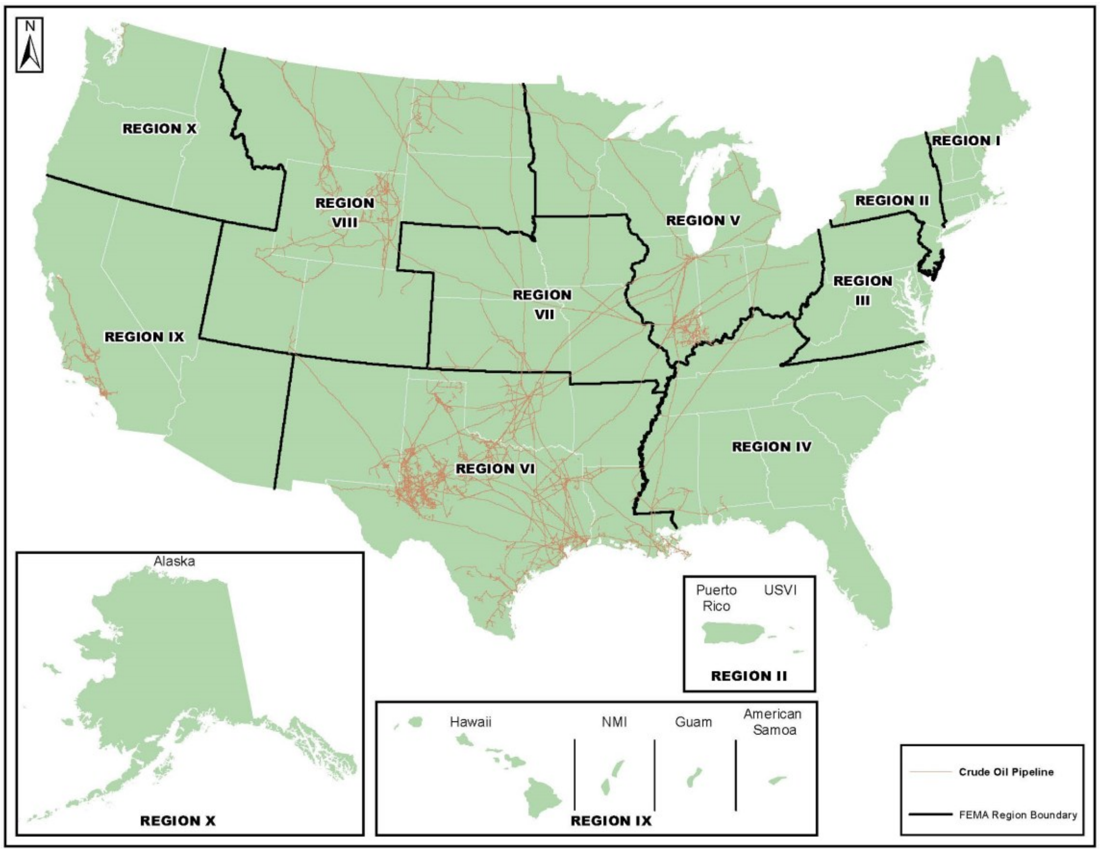
The United States energy supply includes five major energy sources: petroleum (oil), natural gas, coal, nuclear, and renewable energy sources. The associated infrastructure generates and distributes power to meet the supply and demand of our nation's energy needs.

3.10.3.3.1.1 Petroleum and Natural Gas Pipelines

The energy transportation network of the United States consists of over 2.5 million miles of pipelines carrying crude oil, petroleum products, and natural gas. This network includes approximately 175,000 miles of onshore and offshore petroleum pipeline, 321,000 miles of natural gas transmission and gathering pipeline, and over 2 million miles of natural gas distribution pipeline, as shown in Figure 3-29. (Furchtgott-Roth, 2013)

Within the United States, crude oil is primarily found in Texas, Oklahoma, Louisiana, and Wyoming. Approximately 55,000 miles of transmission pipelines bring crude oil from oil producing areas to refineries, where the refined products are provided via pipelines to large storage tanks for local delivery to gas stations and residences, or directly to other consumers. These refined oil pipelines are widely found across the country, with the exception of some New England States (Welch, 2013a).

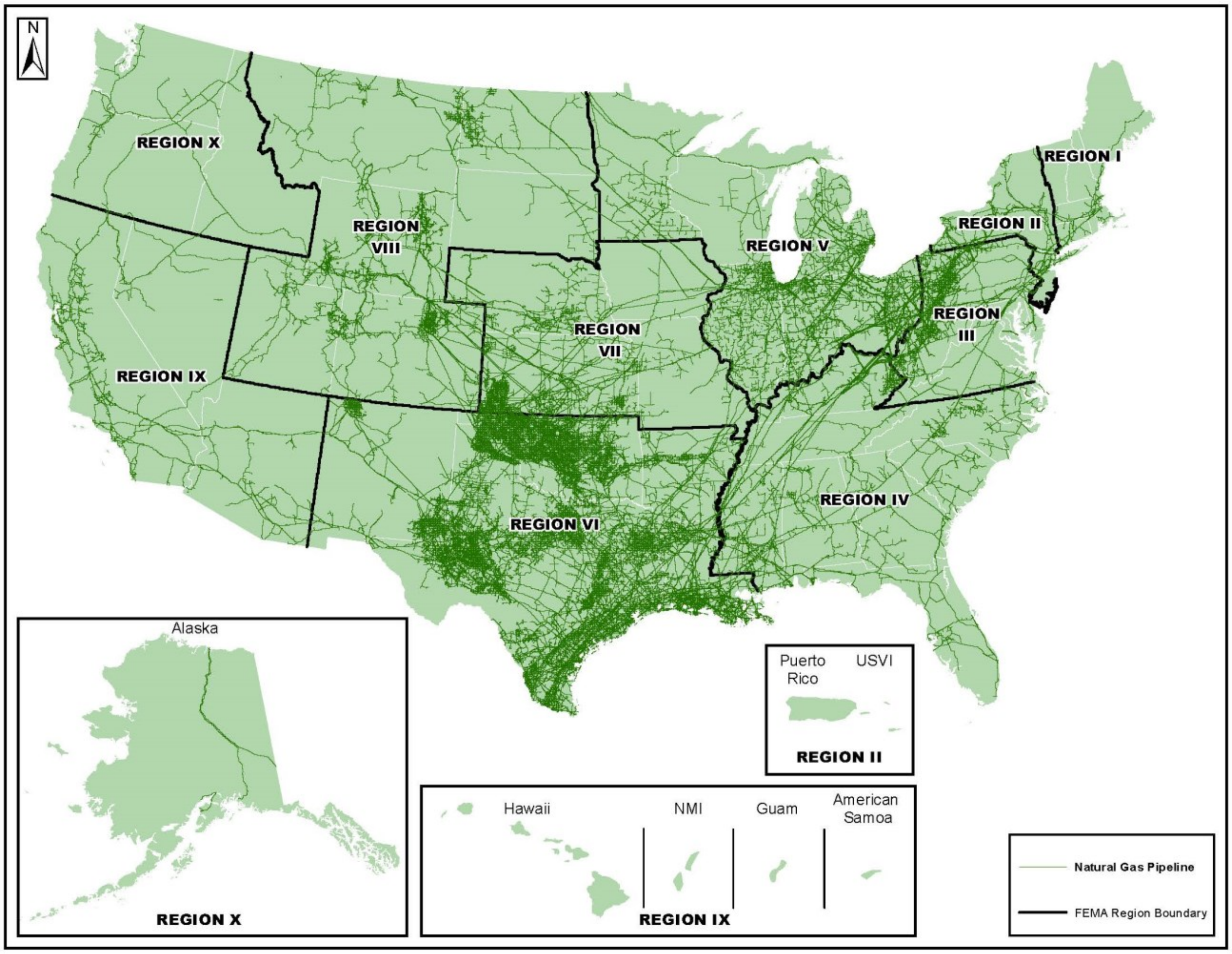
Coastal energy areas include mineral extraction, such as nearshore oil and gas platforms and pipelines. The Gulf Coast Region contributes approximately 54 percent of the nation's total crude oil production, approximately 52 percent of the nation's natural gas production, and approximately 47 percent of the nation's crude oil refinery capacity. As of 2011, approximately 3,701 active oil and gas platforms were based in the Gulf of Mexico, along with approximately 26,590 miles of active oil and gas pipelines. (NOAA, 2011a)



Source: (Homeland Security Infrastructure Program (Gold 2012), 2011a)

Figure 3-29: United States Crude Oil Pipeline Distribution Map

The highest density of natural gas can be found in FEMA Region VI (EIA, 2013a). According to 2011 data from the United States Energy Information Administration (EIA), the States producing the most natural gas included Texas (29 percent), Louisiana (13 percent), Wyoming (9 percent), and Oklahoma (8 percent). The five States that consume the most natural gas were Texas, California, Louisiana, Florida, and New York (EIA, 2013b). Pipelines move natural gas from the producing fields to consumers; Figure 3-30 shows the nationwide natural gas pipeline distribution system. Once the gas reaches a community, the gas flows through a distribution system consisting of main and service lines to reach the consumer. Distribution main lines are generally installed in underground utility easements. Distribution service lines connect to the main lines and run directly into buildings.



Source: (Homeland Security Infrastructure Program (Gold 2012), 2011a)

Figure 3-30: United States Natural Gas Pipeline Distribution Map

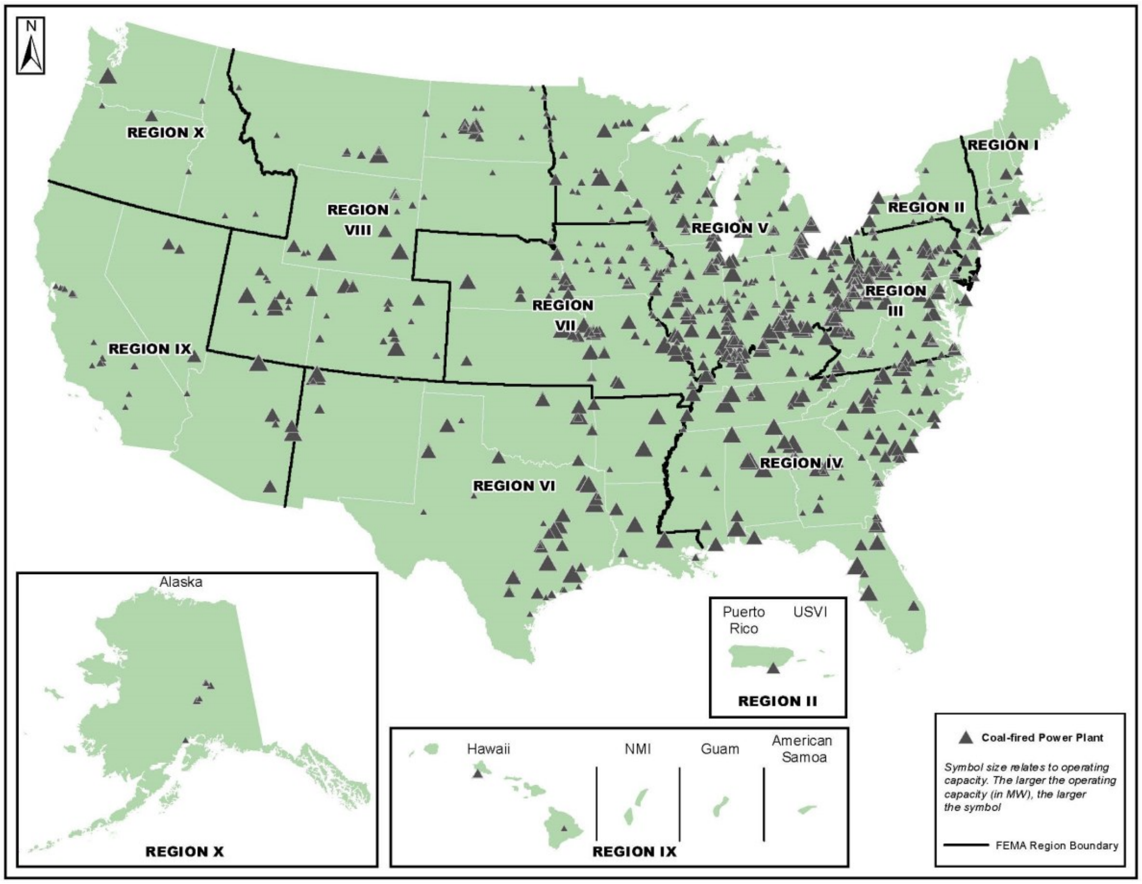
3.10.3.3.1.2 Coal Mining and Coal Power Plants

Coal is the most common fuel source for generating electricity in the United States. Coal is mined in 27 States across the country (Kentucky Educational Television, 2013). The major coal mining States are Wyoming, West Virginia, Kentucky, Pennsylvania, and Texas.

There are two forms of coal mining: surface mining and underground mining. Surface mining (including "mountain top removal") is the most common form of coal mining in the United States. This method is used when the coal is less than 200 feet underground. The soil is removed using large construction equipment to access coal seams. Once the coal is removed, the extracted fill is returned to the pit and the area is remediated. When coal is buried deep below the surface, coal is removed via underground mines. Subsurface mines can be up to 1,000 feet deep, and the coal is transported out from these mines using elevators. Once the coal is extracted and processed onsite, the fuel is shipped across the country. (Tribal Energy and Environmental Information Clearinghouse, Undated).

Approximately 70 percent of our nation's coal is transported via train (see 3.10.3.2.1). Other transportation methods include barge, ship, truck, or pipeline (EIA, 2013c). Coal piers (a facility where coal is transferred between rail and ship) have historically been at ports on the Atlantic Coast and Great Lakes. Many coal pier facilities are still in operation today, including Curtis Bay, MD (CSX, 2012) and Norfolk, VA (The Wall Street Journal, 2013).

As of 2012, the United States had 572 operational coal power plants, which generate 44 percent of the country's electricity, as shown in Figure 3-31 (Union of Concerned Scientists, 2012a). Coal plants use water from nearby lakes, rivers, or oceans to create steam for turning their turbines. Coal plants can withdraw between 70 and 180 billion gallons of water per year and consume as much as 4.0 billion gallons of water per year as a result of evaporation during the cooling process (Union of Concerned Scientists, 2012b). The water that is withdrawn but not consumed is returned to the environment.

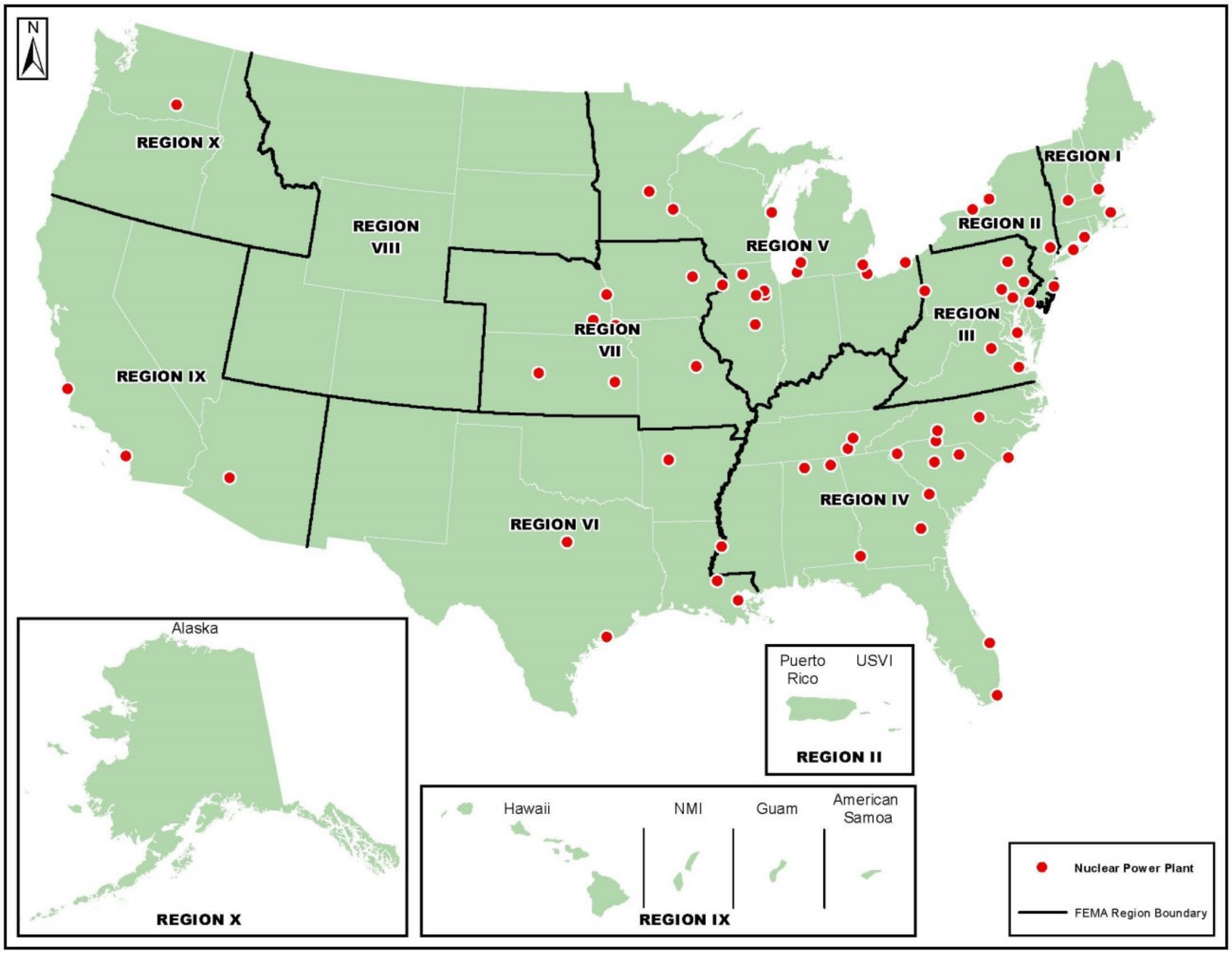


Source: (Homeland Security Infrastructure Program (Gold 2012), 2011b)

Figure 3-31: United States Coal Power Plants Distribution Map

3.10.3.3.1.3 Nuclear Power Plants

Currently, there are 65 operating nuclear power plants, containing 104 nuclear reactors, within 31 States around the country, as shown in Figure 3-32 (EIA, 2013a). The majority of these nuclear facilities are predominantly in FEMA Regions II-V (EIA, 2013a). Nuclear plants are either pressurized water reactors or boiling water reactors and have generated about 20 percent of United States electricity each year since 1990. It is anticipated that four to six new facilities proposed in Tennessee, Georgia, and South Carolina may be operating by 2020 (World Nuclear Association, 2013). Nuclear plants are typically on the coast or along waterways to provide a readily available water source, as required for the internal cooling process. As a result, the risk of natural disasters, such as flooding or tsunamis, must be accounted for during the plant design process.



Source: (Homeland Security Infrastructure Program (Gold 2012), 2011c)

Figure 3-32: United States Nuclear Power Plant System Map

3.10.3.3.1.4 Renewable Energy Infrastructure

Infrastructure related to renewable energy, such as solar and wind energy, is on the rise in the United States. Thirty-nine States, including the territory of Puerto Rico, have installed some form of wind-power generation facilities. According to the American Wind Energy Association, as of December 2012, Texas, California, Iowa, Illinois, and Oregon, have installed the greatest number of wind generation facilities (American Wind Energy Association, 2012). The largest wind farm facilities are in California, Oregon, and Texas; the world's largest wind farm, in California, consists of 490 wind turbines. Favorable conditions, such as abundant wind resources, flat topography, and existing roadways sizable for shipping turbine components, are leading to new development in the Great Plains and the Midwest. Coastal energy areas also are favorable for wind turbines. In June 2013, the first offshore wind turbine, rising only 60 feet, was installed in the United States off the coast of Castine Harbor, ME. As part of the Cape Wind project, 130 wind turbines are anticipated to be constructed in the shoals between Nantucket and Cape Cod, MA. Once completed, the project will be capable of supplying Cape Cod with up to 75 percent of its electricity needs (Bureau of Ocean Energy Management, 2015).

Solar power in the United States is generated by solar power plants, and local sources, such as rooftop photovoltaics. Solar energy power plants are predominantly in California, Arizona, Hawaii, and Colorado (EIA, 2013a). The world's oldest and largest solar power plant is in California. There are now over 9,370 megawatts (MW) of cumulative solar electric capacity operating in the United States, which is enough capacity to power more than 1.5 million average American homes. During the second quarter of Fiscal Year 2013, 438 MW of new solar panels were installed in California, followed by Arizona with 90 MW, and New Jersey with 75 MW (Solar Energy Industries Association, 2013).

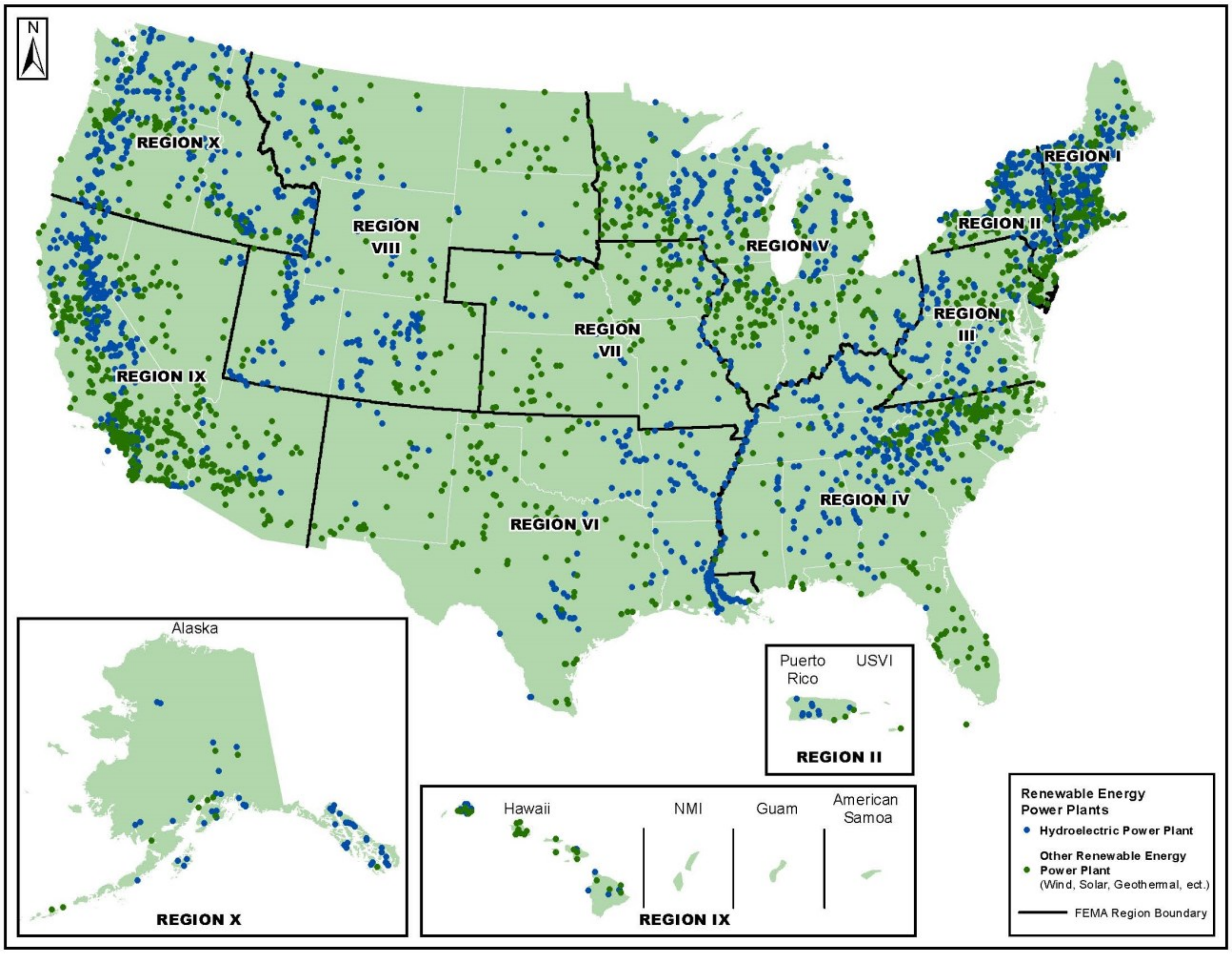
Additional sources of renewable energy, including hydroelectric power, are also generated throughout the country, as shown in Figure 3-33. The largest hydroelectric power generation projects are on the Columbia River and include the Grand Coulee Dam (WA), Chief Joseph Dam (WA), and the John Day Dam (OR) (U.S. Society on Dams, 2015). Coastal regions also include potential energy areas associated with wave and tidal energy. In 2013, the United States Department of Energy (DOE) invested $16M in research to develop reliable wave and tidal devices for capturing energy from waves, tides, and currents (Renewable Energy Focus.com, 2013). Since the development of the Hawaii Clean Energy Initiative in 2008, there has been an increase in the types and number of renewable energy facilities sited, or proposed, in Hawaii's coastal zones. In the past five years, 45 renewable energy facilities have been proposed and 10 sited in Hawaii (Hawaii Coastal Management Program, 2010).

3.10.3.3.1.5 United States Power Grid

The United States' electric power grid originates from power plants (e.g., coal plants, nuclear power plants, renewable power plants) where electricity is transmitted to distribution substations, and from there, it is transmitted to local customer electric power providers. Currently, there are approximately 6,600 power plants operating in the country. (EIA, 2013d)

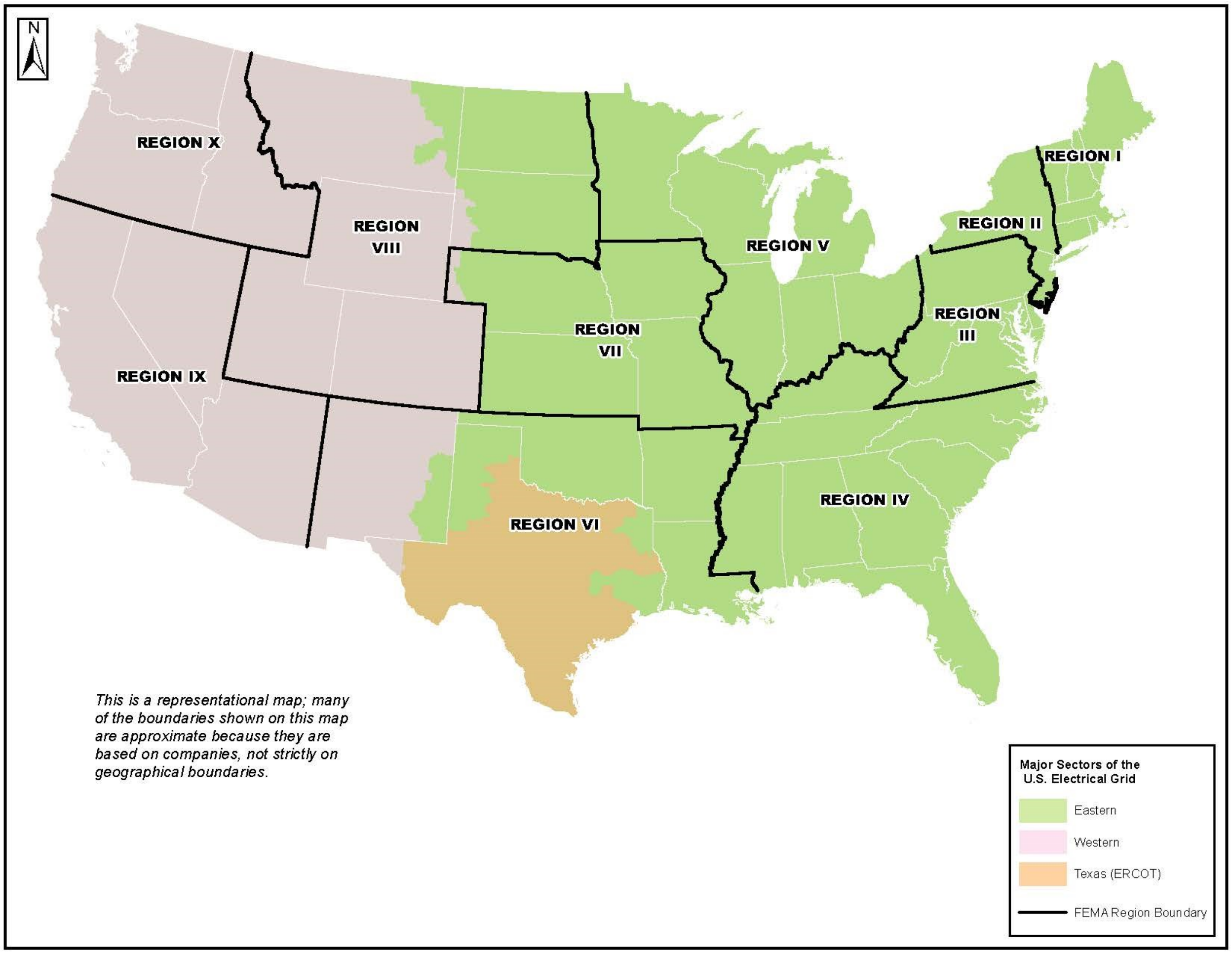
Three main electric power grids exist within the continental United States, as shown in Figure 3-34 the Eastern Interconnected System, the Western Interconnected System, and the Texas Interconnected System. These power grids were designed to create regional inter-State power "highways" to manage the flow of electrical power across the country. Within Alaska, an interconnected power grid system connects Anchorage, Fairbanks, and the Kenai Peninsula, and the remainder of the State is either dependent on small diesel generators or mini-power grids scattered throughout the State. Hawaii is also dependent on mini-grids to serve each island's energy needs. (Welch, U.S. Power Grid, 2013b)

Most electric power in the United States is transmitted through overhead power lines. Underground power transmission is primarily limited to urban areas or sensitive locations due to the significantly higher cost and limited access for maintenance. However, buried cable does have many advantages, including less right-of-way than overhead power lines, lower visibility, and less impacts from bad weather. The contiguous United States power transmission grid consists of more than 200,000 miles of lines operated by over 500 companies (Edison Electric Institute, 2013) (Wald, 2008). The greatest density of transmission lines can be found in the Eastern and Texas Interconnected Systems (FEMA Regions II-VI), with Regions V, VI, and IX having the greatest average voltage, as shown in Figure 3-35.



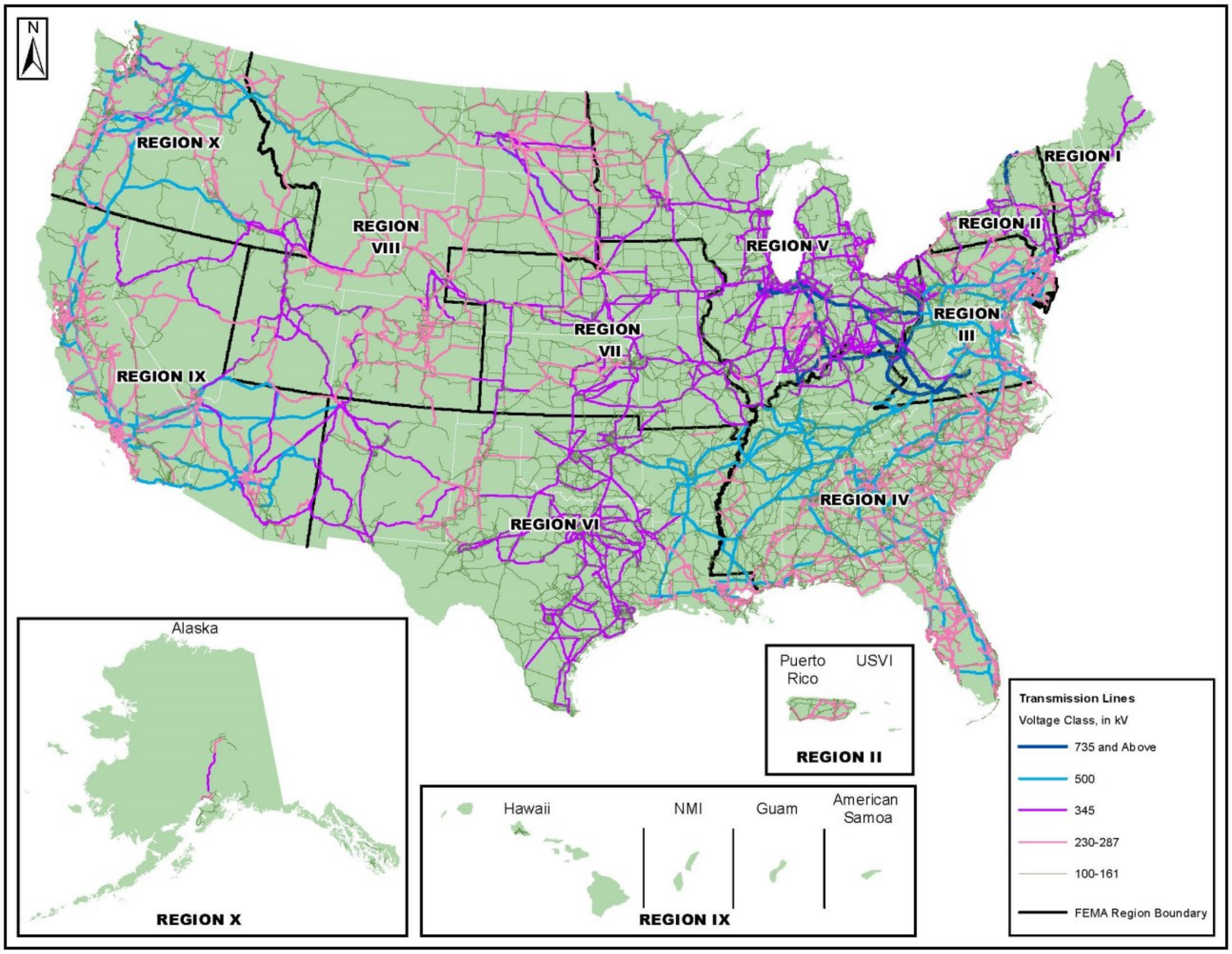
Source: (Homeland Security Infrastructure Program (Gold 2012), 2011b)

Figure 3-33: United States Renewable Energy Power Plants Map



Source: (Homeland Security Infrastructure Program (Gold 2012), 2011d)

Figure 3-34: United States Regional Power Grid Map



Source: (Homeland Security Infrastructure Program (Gold 2012), 2011e)

Figure 3-35: United States Power System Grid Map

3.10.3.3.1.6 Water Supply and Wastewater Infrastructure

Water infrastructure within the United States provides Americans with safe, clean, and reliable drinking water, wastewater services, and stormwater management within their communities. This network serves over 75 percent of our nation's communities and, according to the American Society of Civil Engineers, includes over 800,000 miles of water pipe and 600,000 miles of sewer lines. (EPA, 2011b)

Approximately 160,000 publicly owned water systems provide drinking water to communities nationwide (EPA, 2011c), and approximately 37 percent of the water provided comes from groundwater sources (Nicolet Forest Botting Company, Inc., 2013). Surface water resources, such as rivers, lakes, and reservoirs provide the remaining public water sources. The largest United States reservoirs include Lake Mead, NV; Lake Powell, AZ; Lake Sakakawea, ND; Lake Oahe, SD; and Fort Peck Lake, MT (Stanford University, Undated). Rivers, lakes, and reservoirs are more thoroughly discussed in Section 3.6, Water Resources. Additionally, approximately 15 percent of households in the United States rely on private drinking water wells (EPA, 2012h).

There are an estimated 22,000 publicly owned treatment works (POTW) facilities in the United States that provide wastewater collection, treatment, and disposal services to citizens across the country (University of Michigan, 2012). POTW facilities can also treat discharges from industrial plants, but the quantity and types of industrial waste may be limited by local regulations or treatment plant operators (Harrington & Nelson, 2006). Additionally, one out of four households depends on an individual septic system or small community cluster system for wastewater treatment (EPA, 2012h). States, tribes, and local governments are responsible for regulating household septic systems.

Wastewater systems, including municipal wastewater treatment facilities and combined storm sewer systems, play an important role in protecting community health and local water quality. To minimize any potential effect on water quality, typically onsite sewage disposal systems are restricted within certain distances of a body of water. Municipal wastewater treatment facilities are designed to operate in the event of a natural or man-made disaster, or utility power outage. Under the CWA, the EPA was to develop national pretreatment standards to regulate industrial and other non-domestic wastewater discharges into municipal sewer systems. As a result, the National Pretreatment Program was established as a combined effort of federal, State, and local regulatory environmental agencies to protect water quality. Currently, there are more than 1,500 POTW facilities in the United States that are required to implement local pretreatment programs. (EPA, 2013k)

Combined sewer systems are sewer systems that are designed to collect stormwater runoff, domestic sewage, and industrial wastewater in the same pipe and bring it to the POTW facilities. During rain events, when stormwater enters the sewers, the capacity of the sewer system may be exceeded and the excess water will be discharged directly to a waterbody (rivers, streams, estuaries, and coastal waters) in an event referred to as a combined sewer overflow (CSO). The untreated water could potentially contain untreated sewage, which could impact human health. Most CSOs are in large cities (New York State Department of Environmental Conservation, 2015). In the United States, combined sewer systems serve roughly 772 communities, and approximately 40 million people. Most communities with combined sewer systems (and therefore with CSOs) are in the Northeast, Great Lakes regions, and the Pacific Northwest (EPA, 2008b).

On a more localized level, saturated septic systems may result in environmental damages to local water supplies. Malfunctioning septic systems add excess nutrients (nitrogen and phosphorus) to nearby waters. Failing septic systems are the source of 5 to 10 percent of the phosphorus that reaches lakes, contributing to significant algae blooms. Nitrogen loading from failing septic systems can also adversely affect coastal ecosystems by allowing too much algae (microscopic plants) to grow. The algae cloud the water and prevent vital sunlight from reaching underwater organisms (Casco Bay Estuary Partnership, Undated). California Sea Grant researchers have strong evidence that septic tanks in northern California are leaking nitrogen and phosphorus into coastal waters (California Sea Grant, 2009). In the Mid-Atlantic region, approximately 25 percent of existing households and 33 percent of new developments rely on an individual onsite or small cluster system to treat wastewater. Many of these systems are installed and then largely forgotten until problems arise. It is estimated that at least 10 percent may not be functioning properly (EPA, 2013l).

3.10.3.3.2 Non-Hazardous Solid Waste Infrastructure

According to the EPA, the number of landfills in the United States is declining, while the average size of each landfill is increasing. As of 2007, there were 1,754 municipal solid waste landfills (MSWLFs) across the country (EPA, 2007c). On a national scale, landfill capacity is sufficient; on a regional level, some capacity concerns exist, primarily due to the types and quantity of waste produced, suitable landfill space, and population density.

In 2011, over 250 million tons of trash were generated in the United States, of which 34 percent was recycled or composted (EPA, 2013m). MSWLFs receive residential waste, as well as non-hazardous sludge, industrial solid waste, and construction materials. Some hazardous household waste items may be banned from disposal in landfills, including paint, cleaners, motor oil, and batteries. Landfills can accept household appliances, as long as Federal disposal procedures for ozone-depleting refrigerants are followed, when applicable (EPA, 2012i). Municipal solid waste is typically collected by local municipalities, either directly or by contracted private refuse companies. Alternatively, commercial and industrial waste is collected and disposed of by private companies (EPA, 2012j).

Federal and State regulations require that solid waste landfills avoid sensitive environmental areas and include on-site monitoring systems to detect groundwater contamination or landfill gas. Federal MSWLFs standards can be found in 40 C.F.R. § 258 (Subtitle D of the Resource Conservation and Recovery Act [RCRA]), which requires that landfills be located away from faults, wetlands, floodplains, and other restricted areas (EPA, 2012i). RCRA regulations and hazardous waste are more thoroughly discussed in Section 3.11, Hazardous Wastes and Materials.

3.10.3.4 Telecommunication

The United States telecommunication system is an expansive network across all 50 States, DC, and territories, consisting of radio, telephone, cellular, television, and internet services. Broadband and electronic media (cable television, broadcast television, radio, and direct broadcast satellite), and all other wire and satellite communications, are administered by the Federal Communication Commission (FCC). Coastal communication areas are locations used for shoreside communication towers, undersea communication cables, and similar infrastructure. This includes current and historic areas used for weather stations, radio beacons, and similar devices used to aid airspace and waterway aviation, research listening arrays (e.g., to monitor whale migration), homeland security and emergency response communications, and military alert sensors.

Telecommunication services utilize fiber conduit, utility poles, and telecommunication towers and rely on our nation's expansive satellite network to extend service to consumers. Telephone, cable, and broadband fiber cables are typically installed underground within existing utility or road right-of-ways, or aerially on new or existing utility poles. Telecommunication infrastructure includes towers, microwave equipment, antennas, associated power sources and equipment buildings, and backup generators. In some cases, existing telecommunication infrastructure with excess bandwidth can provide capacity for additional telecommunication services. FCC regulations require that telecommunication infrastructure must comply with all relevant environmental laws and regulations for any proposed construction within the floodplain.

Additionally, the FCC administers policies associated with public safety emergency communication, including the nation's 911 operating system and Emergency Alert System. These services are a critical part of our nation's emergency response and provide a quick and effective method of notifying and informing the public about impending disasters and other emergencies. Communities also rely on the resiliency of their telecommunication infrastructure in the event of disrupted services due to a natural disaster or local emergency. Mobile communication infrastructure, such as portable towers and antenna systems, satellite phones, and mobile command vehicles, can provide temporary assistance. Redundant fiber networks can also provide a backup in the case of an outage.

3.11 HAZARDOUS WASTES AND MATERIALS

Unit of Analysis
FEMA Regions

3.11.1 Definition of the Resource

The RCRA defines hazardous waste as solid wastes, which, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may pose a substantial present or potential hazard to human health or the environment. Risks are higher when hazardous wastes are improperly treated, stored, transported, disposed of, or managed. Hazardous wastes and materials generally are identified by their corrosiveness, ignitability, reactivity, or toxicity. Corrosive material can wear away or destroy a substance (e.g., battery acid). Ignitable material can burst into flames easily (e.g., gasoline). These materials pose a fire hazard; can irritate the skin, eyes, and lungs; and may give off harmful vapors. Reactive material can explode or create poisonous gas when combined with other chemicals. Toxic materials can poison people and other life, causing illness and even death if swallowed or absorbed through the skin (e.g., household cleaners and pesticides).

When hazardous materials are no longer fit for their intended use, they become hazardous waste. Hazardous wastes are most often by-products of industrial or manufacturing processes; they can also be generated from common sources around the home (e.g., batteries, bug spray cans, paint thinner). (PHMSA, 2013a)

This section contains an analysis of the potential effects of hazardous wastes and materials in areas prone to flooding. Specifically, this section discusses: 1) hazardous materials facilities and waste sites (including toxics release inventory facilities; treatment, storage, and disposal facilities; Superfund sites; RCRA Corrective Action Treatment and Disposal Facilities; brownfields; and nuclear power reactors); 2) hazardous material releases; and 3) hazardous material transportation (including pipelines, airways, roadways, and waterways). The unit of analysis for this section, FEMA Regions, was selected to logically group hazardous wastes and materials by geographic/administrative boundaries. Refer to Section 3.1.1 for a more detailed overview of the FEMA Regions.

3.11.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. A discussion of the applicable laws and regulations for Hazardous Wastes and Materials are provided below; Appendix A provides descriptions of these laws and regulations as they apply to this NPEIS.

3.11.2.1 Comprehensive Environmental Responsibility, Compensation, and Liability Act of 1980

Commonly known as the Superfund law, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authorizes the EPA to respond to releases, or threatened releases, of hazardous substances that may endanger public health, welfare, or the environment. Section 105 of CERCLA required the EPA to establish criteria for determining priorities among releases or threatened releases of hazardous substances for the purpose of taking remedial action. To meet this requirement, EPA developed the Hazard Ranking System (HRS) to evaluate sites listed on the National Priorities List (NPL). The HRS is a screening tool used by EPA to assess the relative threat that sites with actual or potential contaminant releases pose to human health or the environment. Using the HRS tool, a score is generated based on an evaluation of up to four separate pathways (or routes by which exposure can occur): groundwater migration, soil exposure, surface water migration, and air migration. The scoring system for each pathway is based on a number of individual factors including likelihood of release/exposure, waste characteristics, and targets.

Additionally, CERCLA designates more than 800 hazardous substances, many of which are commonly used and pose no threat until released into the environment. CERCLA's definition of a hazardous substance codifies definitions of hazardous substances, waste, or air pollutants from other regulations such as the CWA, RCRA, CAA, and the Toxic Substances Control Act. The Superfund program was established as part of CERCLA, and is administered by the EPA in cooperation with individual States and Tribal governments. The EPA Office of Superfund Remediation and Technology Innovation oversees management of the Superfund Program. Superfund sites are also listed on the NPL (EPA, 2011d).

In 1986, CERCLA was amended as a result of lessons learned from managing the Superfund program, known as the Superfund Amendments and Reauthorization Act. Significant updates included stressing the importance of permanent remedies and innovative treatment technologies; requirements to consider other Federal and State environmental laws and regulations; new enforcement authorities and settlement tools; increased State involvement; increased focus on human health problems; greater citizen participation; and an increased trust fund size to $8.5B. The Superfund Amendments and Reauthorization Act also revised the HRS to more accurately reflect risk to human health and the environment by sites placed on the NPL (EPA, 2011e). The NFIP does specifically limit the location of critical facilities, including hazardous materials facilities. However, through the CRS, FEMA encourages communities and localities to establish ordinances prohibiting the construction of critical facilities within the 500-year floodplain and the storage of hazardous materials within the SFHA or even the 500-year floodplain.

3.11.2.2 Resource Conservation and Recovery Act of 1976

The Resource Conservation and Recovery Act (RCRA), an amendment to the Solid Waste Disposal Act of 1965, addresses how to safely manage and dispose of municipal and industrial waste generated nationwide (EPA, 2013n). The hazardous waste program, under RCRA Subtitle C, establishes a system for controlling hazardous waste from the time it is generated until its ultimate disposal, or "cradle-to-grave." RCRA's goals are to: 1) protect the people of the United States from the hazards of waste disposal; 2) conserve energy and natural resources by recycling and recovery; 3) reduce or eliminate waste; and 4) cleanup waste that may have spilled, leaked, or been disposed of improperly (Headwaters Regional Development Commission, 2002).

The RCRA required phasing out land disposal of hazardous waste. Some of the other mandates of this strict law include increased enforcement authority for EPA, more stringent hazardous waste management standards, and a comprehensive regulatory program for underground storage tanks (USTs) that store petroleum or certain hazardous materials. This action came in response to the increasing threat to groundwater posed by leaking USTs. RCRA Subtitle I contains tank design and release detection requirements, as well as financial responsibility and corrective action standards for USTs. Today, there are approximately 581,000 USTs in the United States that store petroleum or hazardous substances (EPA, 2016c). During floods, tanks may be displaced or damaged, and increase the risk of an accidental release. The NFIP does specifically limit the location of critical facilities, including hazardous materials facilities. However, through the CRS, FEMA encourages communities and localities to establish ordinances prohibiting the construction of critical facilities within the 500-year floodplain and the storage of hazardous materials within the SFHA or even the 500-year floodplain.

3.11.3 Existing Conditions—Hazardous Waste Definitions

EPA segregates hazardous waste into four categories: listed wastes, characteristic wastes, universal wastes, and mixed wastes. The hazardous waste identification process is the first step in determining which waste category is most appropriate. Once the waste is determined to meet the definition of hazardous waste under RCRA, the next step is to determine how the waste should be managed. Hazardous waste may be managed through best practices, placards, and other regulatory requirements. Descriptions and examples of each type of hazardous waste are provided below. (EPA, 2012k)

3.11.3.1 Listed Wastes

Listed wastes are divided into three categories: F-list (non-specific source wastes), K-list (source-specific wastes), and P-list or U-list (discarded commercial chemical products). F-list wastes include wastes from common manufacturing and industrial processes, such as solvents used in cleaning or degreasing operations. K-list wastes include wastes from specific industries, such as petroleum refining or pesticide manufacturing. P-list and U-list wastes include specific commercial chemical products in an unused form, including some pesticides and pharmaceutical products once discarded. (EPA, 2012k)

3.11.3.2 Characteristic Wastes

Characteristic wastes do not meet any of the criteria of listed wastes, but do exhibit one of four characteristics: ignitability, corrosivity, reactivity, or toxicity. Ignitable wastes can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 140 ºF. Examples of ignitable wastes include gasoline, paint, and furniture polish. Corrosive wastes are acids or bases that are capable of corroding metal containers. Alkaline cleaning fluid and battery acid are examples of corrosive waste. Reactive wastes can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water. Examples of reactive wastes include waste from cyanide plating, bleach, oxidizers, and explosives. Toxic wastes are harmful or fatal when ingested or absorbed. When toxic wastes are land disposed, contaminants may leach from the waste and pollute groundwater or soils. Examples of toxic wastes include pesticides, weed killers, and many household cleaners. (EPA, 2012k)

3.11.3.3 Universal Wastes

Federally designated universal wastes typically include fluorescent tubes, cathode ray tubes, consumer electronic devices, and mercury-containing equipment and lamps. EPA provides waste regulations, which streamline hazardous waste management standards for federally designated "universal waste." (EPA, 2012k)

3.11.3.4 Mixed Wastes

The last waste category is mixed waste which contains both radioactive and hazardous waste components. These waste types are regulated under the RCRA. Mixed waste is divided into three types: low-level mixed waste (LLMW), high-level mixed waste (HLW), and mixed transuranic waste (MTRU). LLMW waste results from the research, development, and production of nuclear weapons. HLW often contains highly corrosive components, organics, or heavy metals as a result of reprocessing spent nuclear fuel and irradiated targets from reactors. MTRU is primarily generated from nuclear weapons fabrication, plutonium bearing reactor fuel fabrication, and spent fuel reprocessing. (EPA, 2012k)

3.11.4 Existing Conditions—Environmental Hazardous Facilities

Facilities that treat, store, or dispose of hazardous materials are typically required to report data on hazardous materials activities and where those materials pose a threat to human health or the environment. For example, Section 103 of CERCLA requires owners or operators of vessels or facilities to notify the National Response Center of a release of a reportable quantity of a hazardous material. Section 3005 of RCRA establishes a permitting system for treatment, storage, and disposal facilities (TSDFs). The level of reporting varies depending on the type of facility and the quantity of hazardous materials onsite. The purpose of hazardous materials and hazardous waste reporting is to ensure that the public is aware of the nature of the operations in their communities, as well as any accidental releases.

Hundreds of sites and facilities nationwide handle or manage some form of hazardous material or waste. The most common hazardous waste sites encountered are Superfund sites or sites listed on the NPL, [54] RCRA Corrective Action Program facilities, and brownfields. Each is regulated differently and can potentially impact public health or the surrounding environment. The following sections describe the most common, regulated facilities that handle hazardous materials and wastes.

3.11.4.1 Treatment, Storage, and Disposal Facilities

RCRA establishes the authority to regulate TSDFs. These permitted facilities are the last link in the "cradle-to-grave" hazardous waste management system. The requirements for TSDFs are more extensive than the standards for hazardous waste generators and transporters, and include:

- EPA identification numbers;
- Waste analysis;
- Inspection requirements;

[54] "The National Priorities List (NPL) is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation" (EPA, 2016j).

- Personnel training;
- Preparedness and prevention of releases;
- Contingency plan and emergency procedures;
- Manifesting;
- Record keeping and reporting;
- Requirements for releases from solid waste management units, and closure and post-closure requirements; and
- Financial requirements.

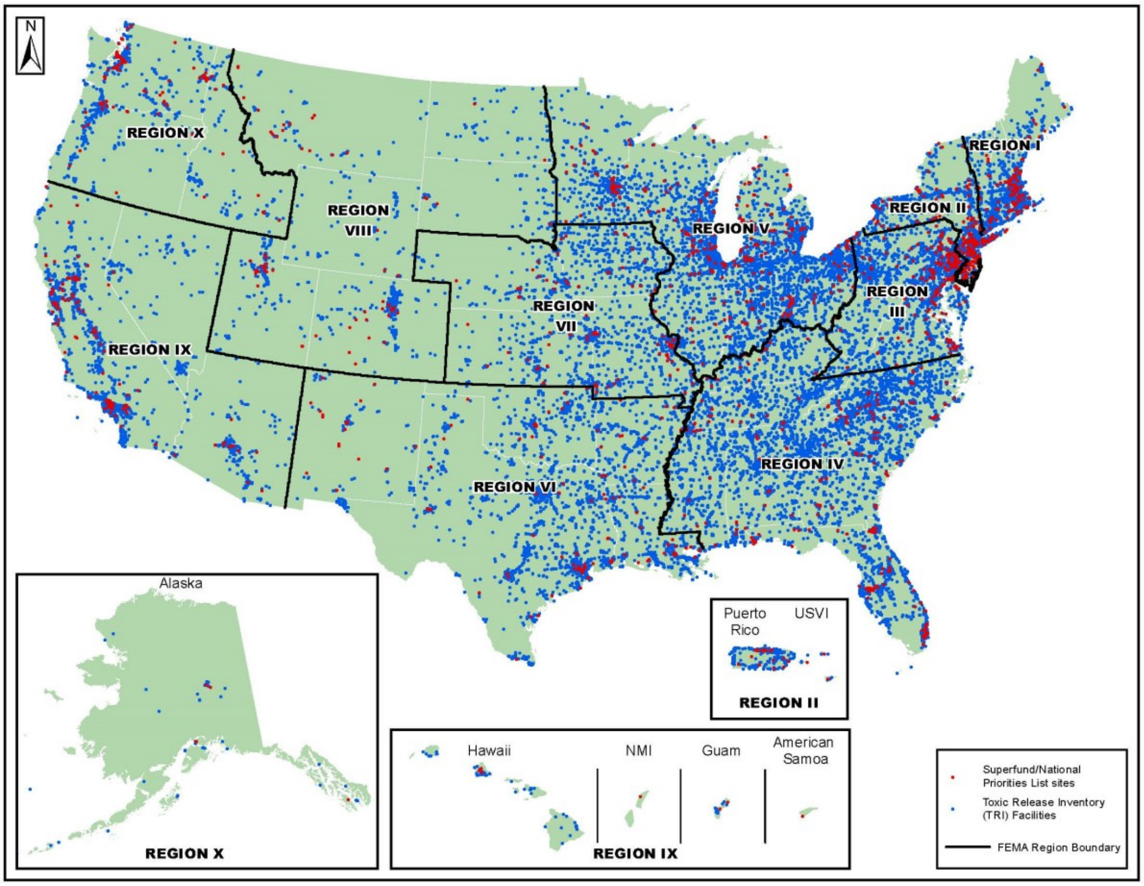
TSDFs also must comply with air emission standards for process vents, equipment leaks, tanks, surface impoundments, and containers, in addition to requirements for containment buildings (EPA, 2012l).

3.11.4.2 RCRA Corrective Action Program Treatment and Disposal Facilities

Under the Hazardous and Solid Waste Amendments, TSDFs are required to cleanup environmental contaminants released into the soil, groundwater, surface water, and air at their sites, regardless of the time of the release. Cleanup activities of TSDFs are referred to as RCRA Corrective Actions. These sites are active facilities that generate hazardous wastes, which can be released into the soil, groundwater, surface water, and air when an accident occurs. To protect public health and the environment from exposure to these releases, the RCRA Corrective Action Program works with responsible facilities to investigate and cleanup the hazardous releases. This program is run by the EPA and 43 authorized States and territories. (EPA, 2013o)

3.11.4.3 Toxics Release Inventory Facilities

In 1986, Section 313 of Emergency Planning and Right-to-Know Act established the Toxics Release Inventory (TRI) in response to public concern about local preparedness for chemical emergencies and the lack of publicly available information regarding hazardous substances. This response was sparked by a deadly toxic methyl isocyanate gas release from a Union Carbide Chemical plant in Bhopal, India in 1984, which killed thousands and is widely considered to be the worst industrial disaster in history. The TRI tracks the release of chemicals emitted into the air or water, or placed in some type of landfill. In general, the TRI covers chemicals that potentially cause cancer or other chronic human health effects, significant adverse acute human health effects, or significant adverse environmental effects. Facilities required to report under the TRI include specific industry sectors, such as manufacturing, mining, and electric power generation; employ 10 or more full-time equivalent employees; and manufacture or process more than 25,000 pounds of a TRI-listed chemical, or otherwise use more than 10,000 pounds of a listed chemical in a given year (EPA, 2013p). The existing Superfund and NPL sites as shown in red, and TRI facilities as shown in blue are illustrated on Figure 3-36 (National Institutes of Health, Undated).



Source: (National Institutes of Health, Undated)

Figure 3-36: NIH TOXMAP® Environmental Health e-Maps

3.11.4.4 Superfund Sites and the NPL

A Superfund site is a highly contaminated, uncontrolled, or abandoned site or Federal facility where hazardous waste is present, with a potential to affect the surrounding community or ecosystem. The Superfund program is the name given to the environmental program established to address abandoned hazardous waste sites. It is also the name of the fund established under CERCLA in 1980 to cleanup land across the nation that is contaminated by hazardous waste. Superfund sites require a long-term cleanup process, which includes removal actions, enforcement against potentially responsible parties, community involvement, and long-term protection. Perhaps the most infamous Superfund program site is Love Canal, in Niagara Falls, NY. Hooker Electrochemical used Love Canal, one of the first Superfund sites added to the program in 1983, for disposal of over 21,000 tons of various chemical wastes between 1942 and 1952. Afterwards, the landfill was covered and the surrounding area extensively developed, including construction of an elementary school and many homes. Heavy rains combined with a record-breaking blizzard in the 1970s caused the water level to rise, bringing contaminated groundwater to the surface, and forcing the evacuation of approximately 950 families from a 10-square block area surrounding the landfill. (EPA, 2012m)

Another example of flooding at a Superfund site is Times Beach. The City of Times Beach (population 2,800) covers 8 square miles on the floodplain of the Meramec River in St. Louis County, MO. In 1972, and again in 1973, the City contracted with a waste oil hauler to spray oil on unpaved roads for dust control. The citizens later learned that the oil used to spray the roads was laced with dioxin and requested EPA to collect samples. The EPA sampled the roads and right-of-ways in November and early December 1982. Soon after EPA collected the samples, the Meramec River flooded the City. Reportedly, the Times Beach community had voted itself out of the NFIP a few years before (St. Louis Magazine, 2010). EPA found dioxin at levels from less than 1 part per billion (ppb) to 127 ppb. As a result, the Centers for Disease Control and Prevention issued a health advisory on December 23, 1982 recommending that people relocated from Times Beach due to flooding should stay away, and that those remaining should leave. The EPA resampled the area in January 1983 to determine if floodwaters had deposited contaminated soil into homes and yards. On February 22, 1983, EPA pledged $33M from the Superfund program to purchase the Times Beach property under a relocation plan to be developed and implemented by FEMA (EPA, 2012n).

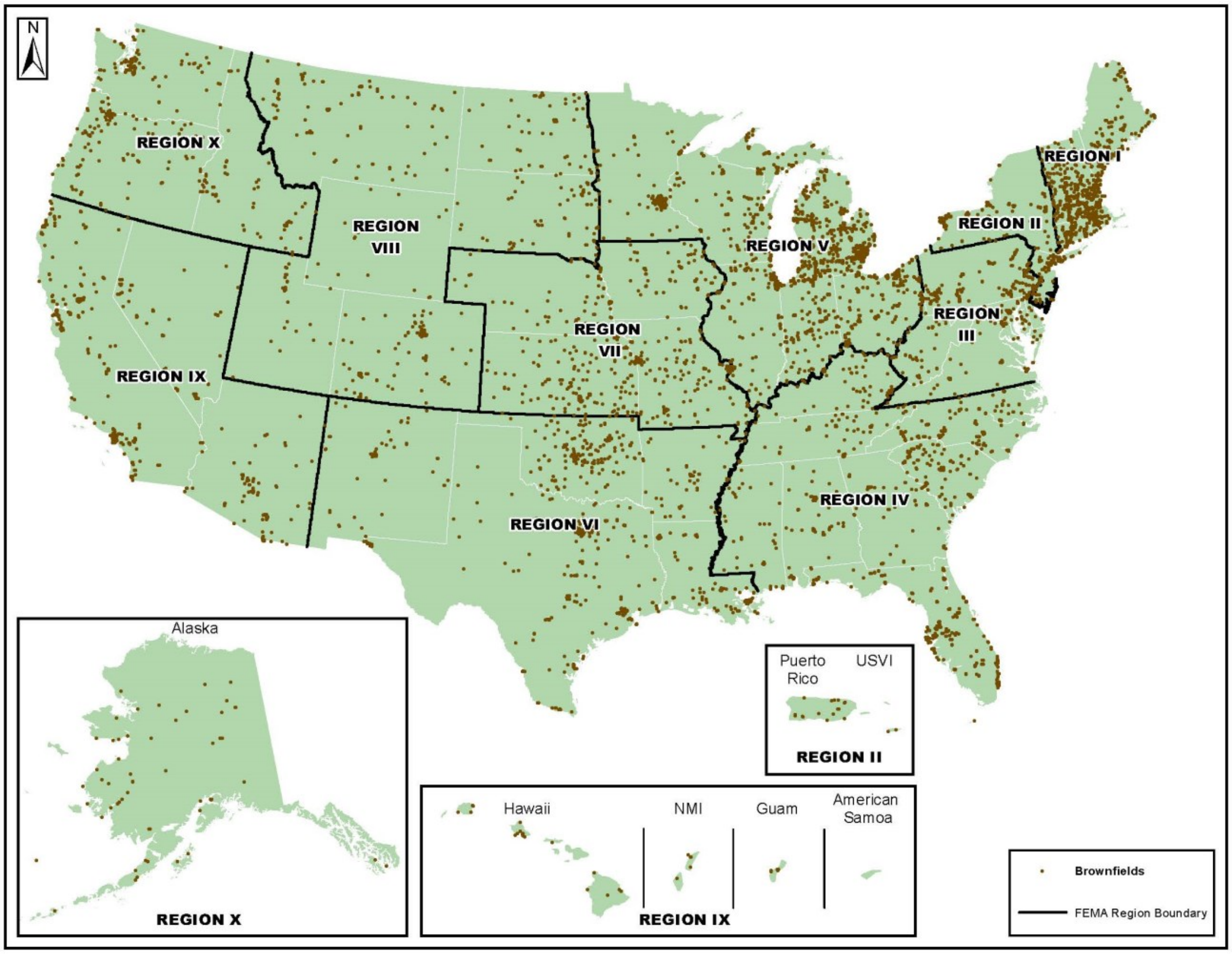
3.11.4.5 Brownfields

A brownfield site is defined as real property, where the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (EPA, 2012o). These sites contain marginal or perceived contamination. Nationwide, it is estimated that more than 450,000 brownfields exist (EPA, 2013q). In many cases, brownfield sites are also found in floodplains, which can add to the cost of development by imposing design restrictions and requirements for both hazard containment and flood alleviation measures. Brownfield sites in the United States as of August 2012 are depicted on Figure 3-37 (EPA, 2013r).

3.11.4.6 Nuclear Power Reactors

Nuclear reactors are facilities that generate electricity by the continuous splitting of uranium atoms (i.e., a nuclear reaction). These facilities are often referred to as nuclear power plants, and generate radioactive waste. Radioactive wastes are the leftovers from the use of nuclear materials for the production of electricity, as well as from the diagnosis and treatment of disease, and other purposes. DOE is responsible for radioactive waste related to nuclear weapons production and certain research activities (Nuclear Regulatory Commission, Undated). Section 3.10.3.3.1.3 provides a detailed explanation of the location and current operation of nuclear power plants in the United States.

Flooding can jeopardize nuclear reactors, potentially contributing to the dispersion of radioactive material to the environment (International Atomic Energy Agency, Undated). In 2011, flooding along the Missouri River in Nebraska jeopardized the Fort Calhoun nuclear plant, allowing flood waters to reach containment buildings and transformers. The incident forced the shutdown of electrical power, which resulted in a 90-minute shutdown of the reactor cooling systems (a high-level operational safety threat) (The Atlantic Wire, 2011). Each of the 104 commercial nuclear reactors in the United States is issued a detailed license, which outlines the conditions under which it may operate, including required shutdown thresholds resulting from rising water levels, wind speeds, or hurricane surges (New York Times, 2011).



Source: (EPA, 2013r)

Figure 3-37: Map of United States Brownfields based on EPA data

3.11.5 Existing Conditions—Hazardous Materials Transportation

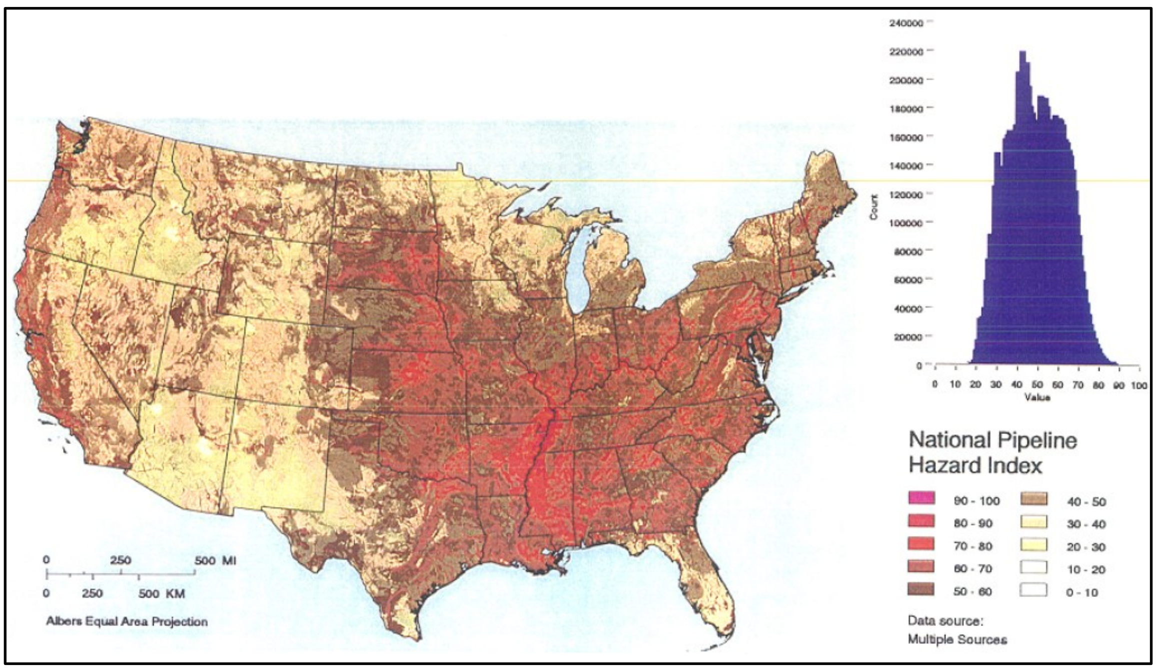
When development occurs in or near a floodplain, transportation infrastructure is often constructed to connect the development. These roads, railways, and waterways can also be used to transport hazardous materials and waste. In the event of a flood, transportation infrastructure can be jeopardized, presenting a risk to the community and surrounding environment. The United States Department of Transportation (DOT) administers a labeling and placarding system for identifying the types of hazardous materials that are transported throughout the nation. The labeling and placarding system assists local emergency officials to identify the nature and potential health threat of chemicals being transported in the event of a release (Headwaters Regional Development Commission, 2002). The Pipeline and Hazardous Materials Safety Administration (PHMSA) is a DOT agency responsible for ensuring that the nation's 2.6 million mile pipeline transportation system is safe, reliable, and environmentally sound. The PHMSA also oversees the nearly 1 million daily shipments of hazardous materials by land, sea, and air. The following sections provide brief descriptions of the most common means for transporting hazardous materials.

3.11.5.1 Pipelines

There are 2.6 million miles of pipeline in the United States that transport natural gas and hazardous liquids. Approximately 64 percent of petroleum products used in the United States are transported by pipe, oftentimes through or near floodplains. Figure 3-29 shows the locations of oil distribution pipelines throughout the United States.

In 1996, FEMA conducted a study on behalf of PHMSA to develop the National Pipeline Hazard Index (NPHI) (PHMSA, 1996). The NPHI assigns a risk value between 0 and 100 for pipeline failure based on natural disasters such as floods, earthquakes, landslides, tornadoes, hurricanes, and other natural hazards. Within the United States, the NPHI is highest (up to 89) in western Tennessee around the New Madrid Fault area. This is due to high flood hazards, earthquake hazards, and landslide hazards. Flood hazards present risks to pipelines including washouts, collisions from debris washing downstream, or scouring (erosion). The PHMSA NPHI for the United States is shown on Figure 3-38 (PHMSA, 1996). A few notable recent pipeline failure incidents resulting from severe flooding are listed below (Federal Register, 2013):

- July 1, 2011: ExxonMobil Pipeline Company experienced a pipeline failure near Laurel, MT resulting in the release of 63,000 gallons of crude oil into the Yellowstone River. The rupture was caused by flood debris washing downstream in the river damaging the exposed pipeline.
- July 15, 2011: NuStar Pipeline Operating Partnership, L.P. reported a 100-barrel anhydrous ammonia spill in the Missouri River, NE. The 6-inch diameter pipeline was exposed and breached by scouring during extreme flooding.
- August 13, 2011: Enterprise Products Operating, LLC discovered a release of 28,350 gallons (675 barrels) of natural gasoline into the Missouri River, IA. According to the metallurgical report, floodwaters scoured supporting soils, causing the pipe to deform and eventually rupture and spill.



Source: (PHMSA, 1996)

Figure 3-38: PHMSA National Pipeline Hazard Index Map of the United States

3.11.5.2 Airways

Air transportation is an alternative method for moving hazardous waste and materials from a location to a containment facility. Although it is strictly regulated following Federal Aviation Administration (FAA) standards and guidelines for commercial transport, air transportation is a quick and safe means to transport dangerous materials to distant locations. Hazardous materials can also be shipped as airfreight by special cargo courier aircraft that specialize in this service. Many airports are located within the 100-year floodplain (EPA, 2013s) including New York City's LaGuardia Airport, which flooded during Superstorm Sandy with 100 million gallons of seawater, closing the airport for 3 days and canceling 3,300 flights. LaGuardia Airport recently received $37.5M in Federal and State funds for different projects to protect against flooding (CBS New York, 2013). Consequently, airway infrastructure is part of the NFIP NPEIS Affected Environment.

3.11.5.3 Roadways

Roadway transport of wastes is the most common form of disposal transport and involves vehicles ranging from small vans to tractor-trailer rigs. These vehicles are DOT-approved and operated by certified drivers. Dump trucks, tube trailers, shipping containers, vans, vacuum trucks, trailers, and straight trucks are commonly used to transport materials such as explosives, flammable solids or liquids, infectious or poisonous substances, corrosives, nonflammable or flammable gases, or poisonous gases. DOT special permits detail the routes for transporting hazardous materials, and may include requirements for check-in times depending on the cargo. The exterior of these vehicles are plainly marked to identify the cargo. However, roadway accidents involving hazardous waste or materials can occur in or near the floodplain.

3.11.5.4 Rail

The Federal Railroad Administration's (FRA) Hazardous Materials Division governs transportation of hazardous materials by rail. These responsibilities include administering a safety program that oversees the movement of petroleum, chemical, and nuclear products throughout the United States rail system, including shipments transported to and from international organizations. As tank cars are the predominant vehicles for carrying hazardous material shipments, the FRA also prepares railcar guidance materials on maintaining, operating, and securing this rail equipment.

Rail transportation of hazardous materials in the United States is recognized to be the safest method of moving large quantities of chemicals over long distances. Rail cars can transport the equivalent load of 280 conventional trucks. Additionally, rail transportation is more cost effective. Train accidents account for 1 percent of those caused by trucks. When hazardous materials are involved, the potential impact on human health and the environment is significantly less than truck transportation. Transportation by rail also has less impact on traffic congestion, often having routes that do not impact city congestion or are not affected by gridlock conditions. Improved freight and tank-car design construction also allows for larger volumes of liquid, gas, or solid, than can be carried by truck. Railway unloading is also swift, safe, and strictly regulated by certified personnel. (FRA, Undated)

While rail transportation is the safest method of moving large quantities of hazardous materials, railway accidents involving hazardous waste or materials often happen in or near the floodplain. According to the

FRA Office of Safety Analysis, nine train accidents occurred between January and July 2013, which resulted in the release of a hazardous material. This represents 1.08 percent of total rail accidents. These incidents resulted in the evacuation of 659 persons (FRA, 2013). On December 1, 2013, a Metro-North train derailed in Bronx, NY on the shore of the Hudson River, killing 4 passengers and injuring 75 passengers (New York Daily News, 2013). While flooding was not a factor in this accident, miles of track exist in close proximity to a shoreline, posing a risk for train derailments in flood conditions.

Flooding can wash out the track right-of-way, leaving the track suspended in midair across the newly formed gap, or collapsing into a ditch. Flooding can also damage or collapse rail bridges due to bridge scour around one or more bridge abutments or piers. In 2004, the remnants of Hurricane Frances, and then Hurricane Ivan, caused a large number of washouts in western North Carolina and other parts of the southern Appalachian Mountains. In 2008, the Cedar River flooded piling homes, industrial waste, and other debris against a Union Pacific railroad bridge in Cedar Rapids, IA (see Figure 3-39). Flooding around Denver, CO in September 2013 washed out several sections of railroad tracks, detouring coal deliveries and Amtrak passengers (Bunch, J., 2013). Other washouts have caused train derailments where tracks have been unknowingly undermined.

Source: (Henshall, 2008)

Figure 3-39: Flood Debris Piled Against a Railroad Bridge in Cedar Rapids, IA

3.11.5.5 Waterways

The International Maritime Organization governs hazardous materials shipped by sea. These materials can be shipped by sea-going vessels or towed on barges, and can include routes along rivers, small canals, lakes, or across oceans. Permits are required for all hazardous wastes and materials that are listed on the vessel's manifest. Additionally, trained crews are required during loading, transport, and off-loading to ensure proper handling of materials and adherence to safety regulations and maritime law. Flooding along inland waters creates hazardous conditions for barges and other vessels, disrupting or closing shipping commerce routes. Additionally, vessels transporting hazardous materials or waste risk releasing chemicals into the environment if impacted by flood waters, either through a damaged hull or capsizing and spilling contents.

3.11.6 Existing Conditions—Hazardous Material Releases

More than 70,000 chemicals are used regularly around the world. If not properly managed, these substances may be accidentally released into the environment through the air, soil, or water. Many factors can contribute to the accidental release of hazardous materials, including a leaching landfill, transportation accidents, and natural disasters such as flooding. Tanks used for storing chemicals can leak and catch fire. Underground storage tanks weaken over time and can leak contents. Train derailments and overturned trucks can spill hazardous materials. Illegal dumping of hazardous waste in sewer systems, abandoned warehouses, or ditches in remote areas also occurs to avoid the cost of safe disposal methods. In addition, hazardous materials may enter the nation's waterways when individuals dispose of unwanted chemicals by pouring them down the sink drain or gutter.

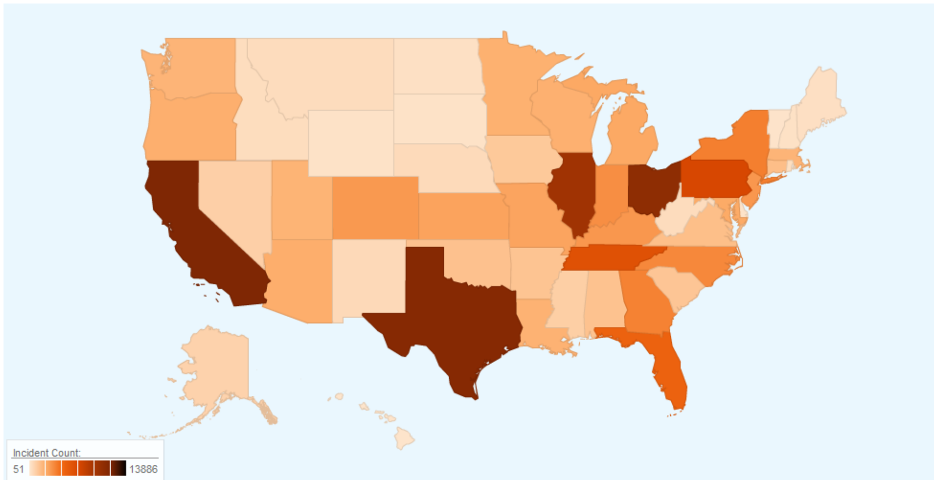
Household, agricultural, or industrial chemicals and agents from flooded hazardous waste sites or homes often contaminate floodwaters. Flood cleanup crews may potentially be exposed to these chemicals leading to headaches, skin rashes, dizziness, nausea, excitability, weakness, and fatigue (Occupational Safety and Health Administration, Undated(a)). Across the nation, these risks are increased in communities near Superfund/NPL designated toxic waste sites, or other industrial facilities that use or produce hazardous materials.

Once a hazardous waste is released into the air, water, or soil, it can migrate, further contaminating the environment and increasing risk to human health, animals, crops, and plant life. The impact of the release on the environment and public health depends on the quantity of material released, and the characteristics of that material. Exposure to hazardous materials can happen through inhalation, ingestion, or dermal exposure. Exposure can be either acute (single exposure for a short time) or chronic (occurs over a much longer period of time, usually with repeated exposures in smaller amounts). One factor increasing risk to human health is bioaccumulation, where tiny amounts of a substance are absorbed and remain in our bodies, accumulating over time to a point at which health is impacted.

The United States Government has developed a plan for responding to both oil spills and hazardous substances releases, called the National Oil and Hazardous Substances Pollution Contingency Plan (commonly referred to as the National Contingency Plan [NCP]). The NCP establishes a National Response Team; defines its roles and responsibilities, as well as general roles and responsibilities for on-scene coordinators; and establishes the unified command structure for managing a response in the event of a natural or man-made incident.

The number of incidents involving pipelines or the transportation of hazardous materials, which were reported to PHMSA for 2012, is illustrated on Figure 3-40 (PHMSA, 2013b). During 2012, a total of 15,432 incidents were reported to PHMSA totaling more than $78.7M in damages (PHMSA, Undated). This number of incidents represents only a small fraction of total releases each year because it does not include accidental releases from industrial processes or other non-transportation releases.

Natural disasters, such as flooding, can create hazardous materials releases from affected industrial facilities. For example, flooding in September 2013 near Denver, CO resulted in thousands of fracking well pads underwater in Weld County, as well as multiple uprighted or tipped-over tanks, the contents of which then leaked into the floodwaters. (Bluedaze Drilling Reform, 2013)



Source: (PHMSA, 2013b)

Figure 3-40: PHMSA 2004-2013 Incident Map of the United States

3.11.7 Existing Conditions—Nationwide Summary

3.11.7.1 FEMA Region I

3.11.7.1.1 Hazardous Waste

Since the Superfund program was initiated in 1980, the program has carried out or is currently involved in the cleanup of close to 700 sites in Region I. Today, Region I has approximately 105 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 288 sites under the RCRA Corrective Action program, and 2,135 brownfields. A breakdown of the hazardous waste cleanup sites in each State for FEMA Region I is provided in Table 3-49.

Table 3-49: Hazardous Waste Cleanup Sites, Region I

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Connecticut	15	165	331
Maine	13	33	324
Massachusetts	33	47	736
New Hampshire	21	18	209
Rhode Island	12	19	292
Vermont	11	6	243
Total	**105**	**288**	**2,135**

Source: (EPA, 2013t)

3.11.7.1.2 Hazardous Materials

Region I contains a total of 1,099 TRI reporting facilities. State totals are as follows: Connecticut (309), Maine (88), Massachusetts (431), New Hampshire (139), Rhode Island (97), and Vermont (35). Region I is home to high-technology industries such as Mass Aerospace, MA, which deals with aviation and missile defense technology, both of which generate acutely toxic chemicals (Mass Aerospace, 2012). Vermont, often referred to as the "granite capital of the world," is home to a multitude of granite mineral extraction quarries and mills. Today, Rock of Ages Corp. owns the only fully operational granite quarry in Vermont (University of Vermont, Undated). Mineral extraction quarries and mills present increased risk for heavy metals contamination during heavy rains or flooding events. Region I is also known for its fresh seafood, which has resulted in a large frozen food industry. Environmental effects from this industry include high water and energy consumption, as well as effluent discharge that may contain high loads of organic matter due to the presence of oils, proteins, and suspended solids (Asian Institute of Technology, Undated).

3.11.7.2 FEMA Region II

3.11.7.2.1 Hazardous Waste

Region II is home to some of the most notable hazardous waste sites in the country, including Love Canal in Niagara Falls, NY. The discovery of toxic chemicals beneath the suburban infrastructure of Love Canal led to the start of the Superfund program. Today, Region II has approximately 218 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 325 sites under the RCRA Corrective Action program, and 857 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region II is provided in Table 3-50.

Table 3-50: Hazardous Waste Cleanup Sites, Region II

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
New Jersey	113	103	273
New York	88	173	518
Puerto Rico	16	48	49
USVI	1	1	17
Total	**218**	**325**	**857**

Source: (EPA, 2013t)

3.11.7.2.2 Hazardous Materials

Region II contains a total of 1,156 TRI reporting facilities. State totals are as follows: New Jersey (392), New York (654), and Puerto Rico (110). Industries in this region that use or produce hazardous materials include primarily pharmaceuticals and mining. Both New York and New Jersey are highly industrialized States, manufacturing a diverse set of products. New Jersey is known as "The Medicine Chest of the World" as it leads the world in pharmaceuticals manufacturing (State of New Jersey, 2013). New York has a large mining industry (ranked in the top 3 States and totaling $1.5B) for crushed limestone, salt, construction sand, gravel, and zinc. New York is also the only State that produces wollastonite (used in ceramics). Mining activities occur in every county within New York except Bronx, Kings, New York, Queens, and Richmond (New York State Department of Environmental Conservation, 2013).

3.11.7.3 FEMA Region III

3.11.7.3.1 Hazardous Waste

Region III has approximately 172 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 566 sites under the RCRA Corrective Action program, and 1,279 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region III is provided in Table 3-51.

Table 3-51: Hazardous Waste Cleanup Sites, Region III

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Delaware	14	17	100
Maryland	20	42	191
Pennsylvania	97	347	672
Virginia	31	117	112
West Virginia	9	41	163
DC	1	2	41
Total	**172**	**566**	**1,279**

Source: (EPA, 2013t)

3.11.7.3.2 Hazardous Materials

Region III contains a total of 1,960 TRI reporting facilities, with the highest number in Pennsylvania. The facilities are distributed as follows: Delaware (62), Maryland (170), Pennsylvania (1,134), Virginia (408), West Virginia (178), and Washington, DC (8). Industries in this region that use or produce hazardous materials include mining of anthracite coal, lumber, petroleum and natural gas extraction, and steel production. West Virginia is the largest coal-producing State in Region III, and the 2nd largest coal-producing State in the country (after Wyoming). More than one-third of the coal produced in the United States comes from Region III, known as the "Appalachian Coal Region" (EIA, 2012). Hazardous materials found in typical surface coal mining operations include brake fluid, grease, lead-acid batteries, solvents, chlorine, herbicides, and dewatering well treatment chemicals such as hydrochloric acid (BLM, 2005b). The manufacturing of iron and steel products was, for a time, Pennsylvania's largest single industry. Now the State also has industries in lumber, petroleum, natural gas, and coal mining (Pennsylvania Historical & Museum Commission, 2013). Virginia has a large tobacco farming industry, which involves the use of a large number of chemicals that can run off into surrounding waterbodies. As a chemical-intensive crop, tobacco requires many applications of insecticides, herbicides, and plant growth regulators. Pesticide application in crop settings is often managed through aerial application, which can increase the risk of contaminating neighboring areas with toxic substances (Toxic Free North Carolina, Undated).

3.11.7.4 FEMA Region IV

3.11.7.4.1 Hazardous Waste

Region IV has approximately 191 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 551 sites under the RCRA Corrective Action program, and 2,545 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region IV is provided in Table 3-52.

Table 3-52: Hazardous Waste Cleanup Sites, Region IV

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Alabama	14	71	156
Florida	56	108	1,083
Georgia	17	75	115
Kentucky	14	61	152
Mississippi	9	34	118
North Carolina	38	89	568
South Carolina	27	53	219
Tennessee	16	60	134
Total	**191**	**551**	**2,545**

Source: (EPA, 2013t)

3.11.7.4.2 Hazardous Materials

Region IV contains a total of 4,135 TRI reporting facilities. State totals are as follows: Alabama (496), Florida (525), Georgia (656), Kentucky (421), Mississippi (297), North Carolina (693), South Carolina (487), and Tennessee (560). Industries in Region IV range from kaolin clay mining in central Georgia to tobacco farming in North Carolina. Kaolin is known as "china clay" and is used in making paper, plastics, rubber, paints, and many other products (Georgia Mining Association, 2013). Georgia also has a large automobile manufacturing industry for Kia Motors. Multiple heavy metals and other hazardous materials are processed in the automobile manufacturing industry, often generating a wastewater sludge that is treated as hazardous waste. The wastewater sludge may include nickel, fluoride, zinc, barium, copper, chromium, tin, formaldehyde, lead, mercury, and xylenes (EPA, 2012p). Tobacco is traditionally one of the most prevalent crops grown in North Carolina, contributing significantly to the State's economy. The growth of tobacco in North Carolina has the same concerns described in Section 3.11.7.3.2 for Virginia's tobacco industry.

3.11.7.5 FEMA Region V

3.11.7.5.1 Hazardous Waste

Region V has approximately 257 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 844 sites under the RCRA Corrective Action program, and 5,068 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region V is provided in Table 3-53. (EPA, 2013u)

Table 3-53: Hazardous Waste Cleanup Sites, Region V

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Illinois	47	149	963
Indiana	37	117	489
Michigan	67	118	1,928
Minnesota	25	84	587
Ohio	43	249	587
Wisconsin	38	127	514
Total	**257**	**844**	**5,068**

Source: (EPA, 2013t)

3.11.7.5.2 Hazardous Materials

Region V contains a total of 5,313 TRI reporting facilities. State totals are as follows: Illinois (1,037), Indiana (860), Michigan (746), Minnesota (478), Ohio (1,354), and Wisconsin (838). Region V is known as much for its agricultural industry as it is for automobile manufacturing. Minnesota, Illinois, and Indiana, ranked 2nd, 4th, and 5th, respectively, for corn production in 2012, according to the National Corn Growers Association (National Corn Growers Association, 2013). Corn is essential in multiple industrial processes, including manufacturing beverages and alcohol, conversion to high-fructose corn syrup, livestock feed, and ethanol fuel. In addition to agricultural runoff of pesticides, using corn in ethanol manufacturing involves the use of multiple hazardous materials. Illinois also leads the nation in machinery manufacturing (construction equipment, farm machinery, machine tools), and hosts multiple agriculture equipment manufacturing companies, including John Deere, All-Steel Equipment Company, Archer Daniels Midland, Kraft, Tate & Lyle, and Caterpillar. Michigan is home to General Motors, Chrysler Group LLC, and Ford Motor Company.

3.11.7.6 FEMA Region VI

3.11.7.6.1 Hazardous Waste

Region VI has approximately 97 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 412 sites under the RCRA Corrective Action program, and 1,445 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region VI is provided in Table 3-54.

Table 3-54: Hazardous Waste Cleanup Sites, Region VI

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Arkansas	9	30	108
Louisiana	12	64	248
New Mexico	15	22	96
Oklahoma	10	35	351
Texas	51	261	642
Total	**97**	**412**	**1,445**

Source: (EPA, 2013t)

Current key hazardous waste issues in Region VI include the Illinois River watershed contamination and the Chevron Questa Mine site. Heavy concentrations of total phosphorous have contaminated the Illinois River watershed in parts of Arkansas and Oklahoma. Contamination is primarily due to heavy poultry production, which generates approximately 354,000 tons of fecal contaminated waste annually (Lithochimeia, LLC, 2009). This waste is largely land-disposed by broadcast spreading, generating large quantities of agricultural runoff. As a result, the Illinois River in Oklahoma and tributaries to the Illinois River in Arkansas (e.g., Osage Creek, Muddy Fork, and Spring Creek) are on the CWA 303(d) list. This listing means that the waters are threatened and impaired due to insufficient pollution controls.

The Chevron Questa Mine site in northeastern New Mexico was added to the NPL in 2011 due to heavy contamination of metals in the soil, groundwater, and surface water. This is primarily due to large piles of acid-generating waste rock and more than 100 million tons of tailings found at the site. This waste has also led to Red River contamination, endangering a cold-water State fish hatchery (EPA, 2016d).

3.11.7.6.2 Hazardous Materials

Region VI contains a total of 2,596 TRI reporting facilities. State totals are as follows: Arkansas (326), Louisiana (353), New Mexico (69), Oklahoma (331), and Texas (1,517). Region VI is highly diverse, changing from the arid, desert-like regions of New Mexico, Oklahoma, and Texas, to the Gulf region in southeast Texas and Louisiana, to the agricultural lands in Arkansas. The discovery of petroleum and natural gas deposits in Oklahoma and Texas has led to a flourishing petrochemical industrial region, developed around Houston and other Gulf of Mexico ports. Flooding may impact the petrochemical industry when flood waters move or tip petroleum tanks, causing the tanks to leak. This occurred during Hurricane Katrina in New Orleans, LA. Texas also includes large manufacturing operations for electrical, communications, aeronautical, automobile-assembly, and aluminum industries. Agricultural operations dominate Arkansas and northern Louisiana, contributing high volumes of pesticides and herbicides to the watershed from runoff. Arkansas also hosts some of the nation's largest bauxite mining operations for aluminum.

3.11.7.7 FEMA Region VII

3.11.7.7.1 Hazardous Waste

Region VII has approximately 71 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 197 sites under the RCRA Corrective Action program, and 2,415 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region VII is provided in Table 3-55.

Table 3-55: Hazardous Waste Cleanup Sites, Region VII

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Iowa	12	47	574
Kansas	13	41	567
Missouri	33	68	1,163
Nebraska	13	41	111
Total	**71**	**197**	**2,415**

Source: (EPA, 2013t)

3.11.7.7.2 Hazardous Materials

Region VII contains a total of 1,404 TRI reporting facilities. State totals are as follows: Iowa (425), Kansas (297), Missouri (506), and Nebraska (176). Region VII includes mostly agricultural-based industries, with Nebraska leading the nation in corn production. Missouri also has a large mining industry for lead (leading the world in production), limestone, coal, crushed stone, and lime. Estimates of lead production since mining began in the early 18th century top 17 million tons, at a value of nearly $5B. Missouri also has the largest active primary lead smelter in the nation (Herculaneum, owned by Doe Run Company) and the largest secondary lead smelter in the world (Buick) (Missouri Department of Natural Resources, Undated). Lead smelting is the process of using a furnace to reduce reclaimed lead-bearing scrap into metallic lead, which can generate lead emissions through lead dust and elevated lead concentrations in surrounding water bodies. Overexposure to lead is the primary cause of workplace illness in the lead industry. Lead is a neurotoxin that interrupts normal brain development and has been linked to behavioral problems in children. Adults can tolerate higher lead levels than children, but can still suffer health problems (Occupational Safety and Health Administration, Undated(b)). Doe Run Company is scheduled to close its lead smelter in Herculaneum in 2013, and is estimated to pay $65M to correct violations of environmental laws at 10 of its lead processing facilities in southeast Missouri (Saint Louis Post Dispatch, 2010).

3.11.7.8 FEMA Region VIII

3.11.7.8.1 Hazardous Waste

Region VIII has approximately 61 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 96 sites under the RCRA Corrective Action program, and 948 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region VIII is provided in Table 3-56.

Table 3-56: Hazardous Waste Cleanup Sites, Region VIII

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Colorado	20	44	414
Montana	18	11	180
North Dakota	0	8	103
South Dakota	2	1	153
Utah	19	23	78
Wyoming	2	9	20
Total	**61**	**96**	**948**

Source: (EPA, 2013t)

3.11.7.8.2 Hazardous Materials

Region VIII contains a total of 643 TRI reporting facilities. State totals are as follows: Colorado (212), Montana (50), North Dakota (56), South Dakota (94), Utah (180), and Wyoming (51). Industrial operations using or producing hazardous materials in Region VIII include mining operations in Colorado for coal, gold, silver, natural soda, gypsum, molybdenum, and uranium. Wyoming is the nation's largest coal producer. Nine of the top 10 coal-producing mines in the nation are in Wyoming, many of which are surface mines (EIA, 2012). Colorado is also a large coal-producing State, with 2,504 coal mines producing an average of 8.52 tons per miner-hour (one of the most efficient rates in the nation). Coal mined in Colorado is used for electricity generation in power plants, cement and steel-making processes, and coal bed methane and coal gasification (Colorado Mining Association, 2007).

3.11.7.9 FEMA Region IX

3.11.7.9.1 Hazardous Waste

Region IX has approximately 114 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 327 sites under the RCRA Corrective Action program, and 2,125 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region IV is provided in Table 3-57.

Table 3-57: Hazardous Waste Cleanup Sites, Region IX

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Arizona	9	37	326
California	99	258	1,459
Hawaii	3	13	27
Nevada	1	13	298
Pacific Islands	2	6	15
Total	**114**	**327**	**2,125**

Source: (EPA, 2013t)

3.11.7.9.2 Hazardous Materials

Region IX contains a total of 1,665 TRI reporting facilities. State totals are as follows: Arizona (260), California (1,251), Hawaii (36), and Nevada (118). California is home to the nation's 2nd and 6th largest census statistical areas (Los Angeles and San Francisco). As a result, California is the nation's leading industrial State, ranking first for almost every general manufacturing category, and is home to more than 44,000 manufacturers (California Manufacturing Technology Consulting, 2013). California also has a rich agricultural industry, producing wine, fruit, milk, and other commodities, most of which require intensive pesticide applications. Arizona is known for its copper mining, and accounts for approximately two-thirds of the nation's total annual production from open-pit operations (Encyclopedia Britannica, 2013). The San Manuel mine, mill, and smelter facilities north of Tucson, AZ encompass approximately 12,000 acres of patented land. The mine is currently the largest underground copper mine in the world (Encyclopedia Britannica, 2013). Open pit extraction for copper ore requires drilling blast holes, typically 37 feet deep and usually 24 feet apart. Ore is then extracted by leaching copper with sulfuric acid to produce a pregnant leach solution, where it is circulated through a series of tanks and ponds to extract the copper. The toxic constituents that are handled in the operations and/or that occur in the materials result in the potential for environmental contamination.

3.11.7.10 FEMA Region X

3.11.7.10.1 Hazardous Waste

Region X includes Alaska, Idaho, Oregon, and Washington. Since the Superfund program was initiated in 1980, the program has carried out or is currently involved in the cleanup of close to 700 sites in Region X. Today, Region X has 80 toxic and hazardous waste sites listed and proposed for listing on the Superfund/NPL, 92 sites under the RCRA Corrective Action program, and 689 brownfields. A breakdown of the hazardous waste cleanup sites in each State within Region X is provided in Table 3-58.

Table 3-58: Hazardous Waste Cleanup Sites, Region X

State	Hazardous Waste Cleanup Site Type		
	Superfund/NPL	RCRA Corrective Action	Brownfield
Alaska	6	5	103
Idaho	9	13	129
Oregon	15	23	271
Washington	50	51	186
Total	**80**	**92**	**689**

Source: (EPA, 2013t)

3.11.7.10.2 Hazardous Materials

Region X contains a total of 727 TRI reporting facilities. State totals are as follows: Alaska (34), Idaho (96), Oregon (282), and Washington (315). Region X hosts a wide array of industries, including aluminum production in the Pacific Northwest States, computer and electronics manufacturing (Microsoft), and aircraft manufacturing (Boeing). A study in 1998 found that the Washington aluminum companies constituted a $2.6B industry, employing 7,510 workers. Alaska also boasts a large seafood industry, primarily related to salmon and king crab.

3.12 SOCIOECONOMIC RESOURCES

Unit of Analysis
FEMA Regions

3.12.1 Definition of the Resource

Socioeconomics are the basic attributes and resources associated with the human environment, including demographic, economic, and social assets of a community. Demographics focus on population trends and age distribution. Economic metrics provide information on income and employment trends and industries. Housing, infrastructure (see Section 3.10), and public services are social assets potentially impacted by the Proposed Action. Environmental justice (EJ), or whether low-income populations or minority populations will be impacted by Federal actions in a disproportionately high and adverse manner, is also included in the discussion of socioeconomic resources. The ability of a community to prepare for and respond to flood events—including procuring flood insurance pre-event and recovering post-event with personal, business, community, State, FEMA, and other Federal resources—may be directly impacted by socioeconomic characteristics. Therefore, an understanding of current socioeconomic conditions is essential to evaluating and understanding the impacts of proposed changes to the NFIP. Wherever possible, population and housing data are drawn from the United States Census Bureau's (USCB) decennial census, USCB's American Community Survey, and equivalent authoritative sources, such as the Bureau of Labor Statistics, to ensure the most complete and accurate information possible is used in this NPEIS.

This section will consider: 1) population and demographics, 2) economic characteristics, 3) housing characteristics, 4) EJ, 5) SFHAs, 6) flood insurance policies and premiums, 7) ecosystem services, 8) natural disasters, and 9) public health and safety services. The unit of analysis for this section, FEMA Regions, was selected to logically group socioeconomic considerations by geographic/administrative boundaries. Refer to Section 3.1.1 for a more detailed overview of the FEMA Regions.

3.12.2 Applicable Statutes and Regulations

The Proposed Action must meet the requirements of NEPA, and other applicable laws and regulations. A discussion of the applicable laws and regulations for Socioeconomic Resources is provided below.

3.12.2.1 EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations)

EO 12898*, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs agencies to address environmental and human health conditions in minority and low-income communities. EJ addresses the disproportionate and adverse effects of a Federal action on low-income or minority populations. The intent of EO 12898 and related directives and regulations is to ensure that low-income and minority populations do not bear a disproportionate burden of negative effects resulting from Federal actions. The general purposes of EO 12898 are the following:

- To focus the attention of Federal agencies on human health and environmental conditions in minority communities and low-income communities with the goal of achieving EJ;
- To foster nondiscrimination in Federal programs that substantially affect human health or the environment; and
- To give minority communities and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

3.12.3 Existing Conditions—Population and Demographic Characteristics

The United States has seen strong population growth over the past 15 years, although growth was stronger from 2000 to 2010 than from 2010 to 2015. The nation's annual growth rate in the 2000 to 2010 period (0.91 percent) was higher than the rate during the 2010 to 2015 period (0.78 percent). The racial composition of the country has shifted since 2000, with indications of continuing trends. White individuals have declined as a percentage of the total population, although they still represent the majority. There have been other shifts in racial composition, including an increase in the percentage of Asians and slight increases in the percentages of African Americans and persons of two or more races. Hispanic is an ethnic designation, not a racial one; therefore, percentage figures for Hispanic status are separate from racial status figures. The percentage of the population identifying themselves as Hispanic or Latino has grown from 13.7 percent in 2000 to 18.2 percent in 2014. The percentage of the population that is over the age of 65 has increased, and is expected to continue increasing with the aging of the "Baby Boomer" generation (born between 1946 and 1964). The percentage of the population that is under the age of 18 has declined slightly between 2000 and 2015. Table 3-59 shows the change over time in total population, and Table 3-60 shows the change over time in age, racial, and ethnic composition.

Table 3-59: Total Population of the United States, 2000–2015

	United States
Total Population 2000	285,620,445
Total Population 2010	312,846,492
Change 2000 – 2010	27,226,047
AARC 2000 – 2010	0.91%
Total Population 2015	325,279,786
Change 2010 – 2015	12,433,294
AARC 2010 – 2015	0.78%

AARC: Average Annual Rate of Change

Source: (U.S. Census Bureau, 2000a) (U.S. Census Bureau, 2010) (United Nations, 2015)

Table 3-60: Age, Racial, and Ethnic Composition of the United States, 2000–2014

	U.S. Percent of Population in 2000	U.S. Percent of Population in 2010	U.S. Percent Change in Share 2000 – 2010	U.S. Percent of Population in 2014	U.S. Percent Change in Share 2010 – 2014	U.S. Percent Change in Share 2000 – 2014
Age						
Under 18	25.7%	24.0%	-1.7%	23.1%	-1.0%	-2.7%
Over 65	12.4%	13.1%	0.6%	14.5%	1.5%	2.1%
Racial Compositions						
White	75.2%	72.4%	-2.8%	73.3%	0.9%	-1.9%
Black or African American	12.3%	12.6%	0.3%	12.6%	0.0%	0.4%
American Indian or Native Alaskan	0.9%	0.9%	0.1%	0.8%	-0.1%	-0.1%
Asian	3.6%	4.7%	1.1%	5.2%	0.5%	1.6%
Native Hawaiian or Pacific Islander	0.1%	0.2%	0.0%	0.2%	0.0%	0.0%
Other race	5.5%	6.2%	0.7%	4.8%	-1.4%	-0.7%
Two or more races	2.4%	2.9%	0.5%	3.0%	0.1%	0.6%
Ethnic Composition						
Hispanic or Latino	13.7%	17.3%	3.6%	18.2%	0.9%	4.5%

Source: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

3.12.4

3.12.5 Existing Conditions—Economic Characteristics

This section discusses several key indicators of economic status. These key indicators include income, poverty, unemployment, and employment by industry sector. These indicators provide information about economic activity and economic performance.

Per Capita Income is the average amount of income generated by each person in the nation (or a region or other geographic area), and is calculated by taking the total income of the geographic area and dividing it by the total number of people in the geographic area. It takes into account all individuals, not just those in families. Because it is an average, it is somewhat subject to the upward bias exerted by small numbers of extremely high-income earners. However, this bias is mitigated by the very large base (the entire population) at the national and regional levels. Income is measured by the USCB as the amount of money income received from the following sources: earnings (wages, salaries, and self-employment income); unemployment compensation; workers' compensation; social security; supplemental security income; public assistance; veterans' payments; survivor benefits; disability benefits; pension or retirement income; interest; dividends; rents, royalties, and estates and trusts; educational assistance; alimony; child support; financial assistance from outside of the household; and other income (USCB, 2012a). Money income does not reflect non-cash income, such as food stamps and health benefits.

Individuals below the Poverty Level is a simple measure of the poverty rate across the entire population. This indicator counts all individuals who currently live in poverty status, whether as individuals living alone or in households or families that are defined as below the poverty level. The poverty threshold for individuals and families is updated annually to correspond with increases in the Consumer Price Index. The United States has undergone two recessions since 2000, each of which has been part of a larger cycle of recessions followed by economic expansion and growth (National Bureau of Economic Research, 2016). These recessions, and their impact on employment, have negatively impacted household income and led to a rise in poverty. Table 3-61 shows snapshots of these economic indicators and the annual average unemployment rate at different times in the recent past.

Table 3-61: Economic Indicators in the United States, 2000 – 2014

	U.S. Value in 2000	U.S. Value in 2010	U.S. Percent Change 2000 – 2010	U.S. Value in 2014	U.S. Percent Change 2010 – 2014	U.S. Percent Change 2000 – 2014
Per Capita Income	$30,602	$40,277	31.6%	$46,049	14.3%	50.5%
	U.S. Value in 2000	**U.S. Value in 2010**	**U.S. Percentage Point Change 2000 – 2010**	**U.S. Value in 2014**	**U.S. Percentage Point Change 2000 – 2014**	**U.S. Percentage Point Change 2000 – 2014**
Annual Average Unemployment	4.0%	9.6%	5.6%	6.2%	-3.5%	2.2%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	12.9%	15.7%	2.8%	15.8%	0.2%	2.9%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

An economic recovery and growth cycle, and associated impact on employment, does not necessarily provide uniform growth throughout the economy, but instead may lead to growth in some industries and a decline in others. The Bureau of Labor Statistics classifies workplaces into industries based on their principle product or activity. An analysis of employment provided by industry (or "sector") as a percentage of total employment can illustrate shifts in the economy. For example, manufacturing jobs, which were hit particularly hard in the Great Recession (economic downturn from 2007 – 2009), had been on the decline for the past two decades due to restructuring in the global economy and a shift of manufacturing jobs to developing countries (Szirmai, 2009), and are therefore less likely to make the same recovery as other sectors. Since 2000, manufacturing employment has declined considerably, whereas health care and social assistance sector jobs increased significantly. The strongest growth has occurred in the education and health services sector (increase in share of 2.1 percent from 2000-2014) and in the real estate and rental and leasing sector (up 1.1 percent). Table 3-62 shows employment numbers by industry sector from 2000 through 2014.

All of the industries in Table 3-62 are susceptible to disruption by flood events, if a business activity is within an SFHA or dependent on infrastructure, suppliers, or markets within an SFHA. In inland areas, many U.S. cities, towns, and rural areas have substantial economic activities in areas at risk for riverine flooding. For instance, businesses in the trade, transportation, and utilities sector often have significant assets in floodplains due to proximity to water-based transportation or railroads and highways that follow rivers. Agricultural businesses (classified within the natural resources and mining sector) often have farm buildings and other assets in floodplains due to the rich soils usually found there.

In coastal areas, major storms and hurricanes can impact economic activities in or reliant upon the ports and harbors that provide for trade and transportation of personnel and goods to regional, national, and global markets. In 2009, the United States marine transportation industry supported $2T in commerce and employment for more than 13 million people, handling more than 2.5 billion short tons of domestic and foreign commerce (USACE, 2009b). Commercial fishing operations, classified within the natural resources and mining sector, are naturally reliant on coastal locations and are important to the economies of many coastal areas. Nuclear and fossil fuel electric power plants (mostly classified within the trade, transportation, and utilities sector) are frequently sited within coastal areas; this provides close access to coastal waterways, which are used for transporting fuel or cooling power-plant equipment, and supporting near-shore oil and gas platforms and pipelines, on- and off-shore wind turbines, and wave and tidal energy infrastructure. Tourism and recreation assets are important economic engines in many coastal areas. These assets include beaches, coastal restaurants, hospitality enterprises (hotels, motels, bed & breakfasts, boardwalk vendors), parks and historic sites, museums, and recreation-service providers (e.g., charter fishing, diving, whale-watching, and watersport rental facilities).

Businesses associated with these coastal activities are largely classified in the leisure and hospitality sector. Many military bases are in coastal areas. Their uniformed and civilian personnel are classified as Federal government employees. Military bases also purchase goods and services from many of the other sectors in Table 3-62. Finally, the beauty and desirable lifestyle of coastal areas drive development of residences (including second homes). This development activity is very important to the economies of many areas, and is reflected in the construction sector and in service-providing sectors that rely heavily and directly on consumers, such as financial activities, professional and business services (including real estate sales and management businesses), and education and health services.

Table 3-62: Employment by Industry Sector for the United States, 2000 – 2014

	U.S. Total Jobs in 2000	U.S. Total Jobs in 2010	U.S. Total Jobs in 2014	U.S. Percent Change from 2000 – 2014
Total Jobs, all industries	165,370,800	173,034,700	185,798,800	12.4%
	U.S. Percentage of Total Jobs in 2000*	**U.S. Percentage of Total Jobs in 2010***	**U.S. Percentage of Total Jobs in 2014***	**U.S. Percent Change in Share from 2000 – 2014**
Farm employment	1.9%	1.5%	1.4%	-0.5%
Forestry, fishing, and related activities	0.5%	0.5%	0.5%	0.0%
Mining, quarrying, and oil and gas extraction	0.5%	0.7%	0.9%	0.5%
Utilities	0.4%	0.3%	0.3%	-0.1%
Construction	5.8%	5.1%	5.2%	-0.6%
Manufacturing	10.7%	7.0%	7.0%	-3.7%
Wholesale trade	3.8%	3.5%	3.5%	-0.3%
Retail trade	11.2%	10.2%	10.1%	-1.1%
Transportation and warehousing	3.3%	3.2%	3.4%	0.0%
Information	2.4%	1.9%	1.8%	-0.7%
Finance and insurance	4.7%	5.3%	5.3%	0.6%
Real estate and rental and leasing	3.3%	4.4%	4.4%	1.1%
Professional, scientific, and technical services	6.1%	6.8%	6.9%	0.8%
Management of companies and enterprises	1.1%	1.2%	1.3%	0.2%
Administrative and support and waste management and remediation services	6.0%	6.0%	6.3%	0.3%
Educational services	1.7%	2.4%	2.4%	0.7%
Health care and social assistance	9.1%	11.0%	11.2%	2.1%
Arts, entertainment, and recreation	1.9%	2.2%	2.2%	0.3%
Accommodation and food services	6.4%	6.9%	7.3%	0.9%
Other services (except public administration)	5.4%	5.7%	5.9%	0.5%
Government and government enterprises	13.9%	14.3%	12.9%	-0.9%

Source: (Bureau of Economic Analysis, 2016b)

3.12.6 Existing Conditions—Housing Characteristics

The housing market can be an indicator of economic health and activity, due to its link to employment in the construction industry and other indirect effects. It can also serve as an indicator of cost of living and affordability in an area. Relevant factors when analyzing the housing market include total housing units, median home value, percentage of housing units that are occupied ("occupancy rate"), and percentage of owner-occupied units ("home ownership rate"). These factors are indicators of growth of the housing stock, affordability, housing availability, and neighborhood stability. Table 3-63 shows these indicators from 2000 to 2014. Growth in housing units was stronger from 2000 to 2010 than from 2010 to 2014, even when accounting for the first period being longer. Home values in 2010 reflected the impact of the

Great Recession. These values increased at a significant rate in the 2010 to 2014 period, making a steady recovery. The overall occupancy rate decreased throughout the period, as did the home ownership rate, indicating the impact of the recession on housing utilization.

Table 3-63: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in the United States, 2000 – 2014

	U.S. Value in 2000	U.S. Value in 2010	U.S. Percent Change 2000 – 2010	U.S. Value in 2014	U.S. Percent Change 2010 – 2014	U.S. Percent Change 2000 – 2014
Total Housing Units	117,323,117	133,341,676	13.7%	135,534,245	1.6%	15.5%
Median Home Value*	$130,432	$189,817	45.5%	$228,549	20.4%	75.2%
Percentage of Housing Units Occupied	91.0%	88.6%	-2.4%	87.4%	-1.1%	-3.6%
Percentage of Owner-Occupied Housing Units	66.3%	65.2%	-1.1%	63.2%	-2.0%	-3.1%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.7 Existing Conditions—Environmental Justice

EJ can be defined as "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"(EPA, 2016e). EO 12898 requires that each Federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations"(Executive Office of the President, 1994).

Regulatory Definitions and Thresholds for Environmental Justice

The publication *Environmental Justice Guidance Under NEPA* (CEQ, 1997a) is commonly used in EJ evaluations. It states that "low-income" should be determined using the annual statistical poverty thresholds from the Bureau of the Census. The thresholds are based on various factors such as income and family size.[55] Table 3-64 shows poverty thresholds for individuals, a family of two, and a family of four.

[55] Poverty thresholds are defined by the USCB using the Office of Management and Budget's Directive 14, which is based on a set of money income thresholds. Non-cash benefits such as public housing, Medicaid, and food stamps are excluded (USCB, 2012a). The thresholds are defined for individuals and families, and are increased every year by the same percentage as the increase in the average Consumer Price Index.

Table 3-64: Poverty Thresholds, 2000 – 2014

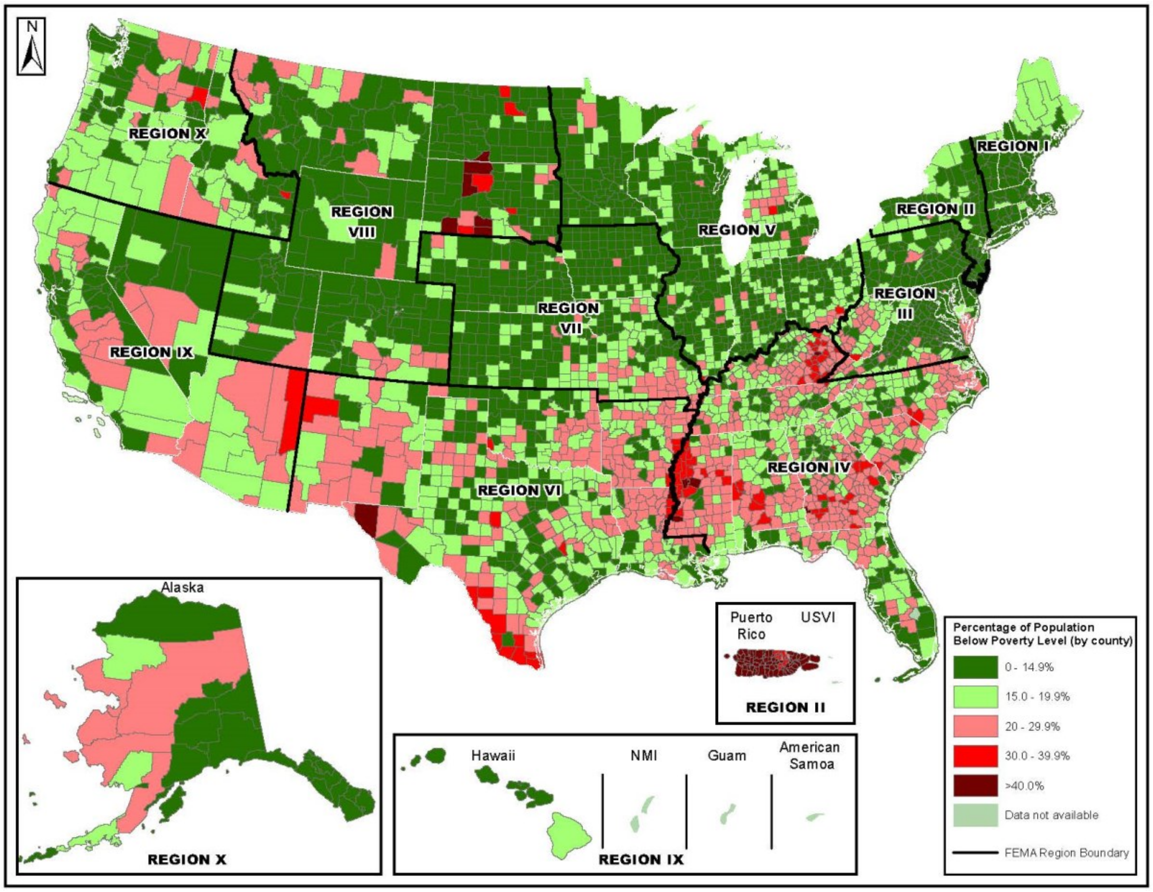
Size of Family Unit	Year		
	2000	2010	2014
Individuals	$8,794	$11,137	$12,071
Family of Two	$11,239	$14,216	$15,379
Family of Four	$17,603	$22,315	$24,230

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

The CEQ guidance (CEQ, 1997a) further states, "In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect." For the purposes of this NPEIS, the geographic proximity approach is most appropriate, because floodplains are a geographic concept. Further, to identify low-income communities in terms of individuals living in proximity to one another, this EIS adopts the USCB definition of a "poverty area" as a census tract in which 20 percent or more of its residents have incomes below the poverty threshold. The USCB also defines an "extreme poverty area" as one in which 40 percent or more of its residents have incomes below the poverty level. Studies of concentrated poverty commonly use these definitions. (Kneebone, Nadeau, & Berube, 2011)

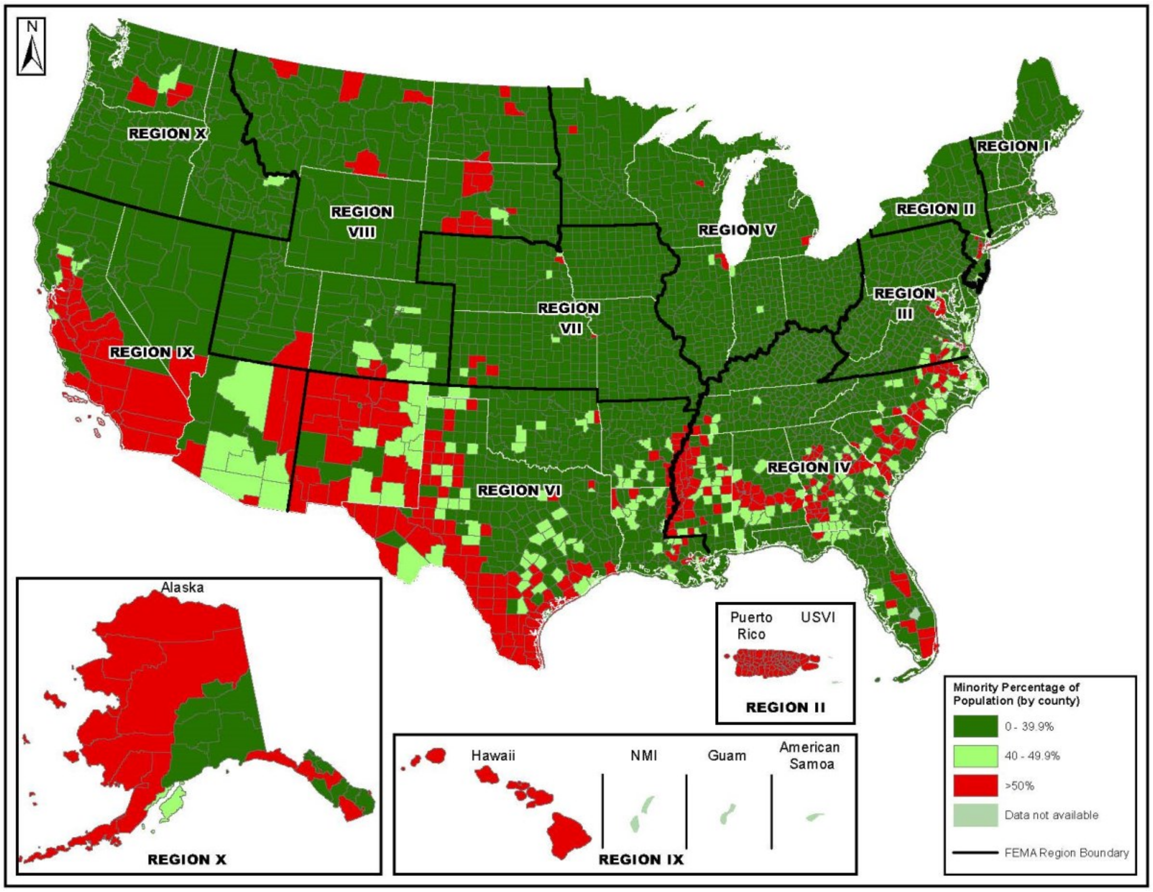
As defined in *Environmental Justice Guidance Under NEPA* (CEQ, 1997a), minority populations include persons who identify themselves as Asian or Pacific Islander, American Indian or Alaskan Native, Black (not of Hispanic origin), or Hispanic. Race refers to census respondents' self-identification of racial background. Hispanic status is also self-identified; it refers to ethnicity and language, not race, and may include persons whose heritage is Puerto Rican, Cuban, Mexican, and Central or South American. According to the guidance, a minority population exists where the percentage of persons in one of the race and ethnic groups noted above either exceeds 50 percent or is meaningfully greater than the minority percentage in the general population. In addition, a minority population also exists if there is more than one minority group present and the minority percentage, when calculated by aggregating all minority persons, either exceeds 50 percent or is meaningfully greater than the general population. To identify minority communities, this EIS adopts the 50 percent criteria, applied to small-scale geographic areas.

As detailed earlier, Table 3-60 and Table 3-61 provide information about racial composition and poverty. However, the concept of EJ is one that is location-based because it deals with potentially disproportionately high and adverse impacts to low-income and minority communities. Figure 3-41 and Figure 3-42 show the distribution of low-income population and minority population, respectively, by county. The poverty data is from the USCB American Community Survey from 2008 to 2012 (USCB, 2012c). The minority data is from on the 2010 decennial census (USCB, 2014). Counties with high rates of low-income or minority populations are most likely to have low-income and minority communities. However, low-income and minority communities may exist in any county.



Sources: (USCB, 2012c) (USCB, 2013b)

Figure 3-41: Percentage of Population Below the Poverty Level by County, 2008–2012



Sources: (USCB, 2014) (USCB, 2013b)

Figure 3-42: Minority Percentage of Population by County, 2010

3.12.8 Existing Conditions—Special Flood Hazard Areas

Previous sections have addressed demographic, economic, housing, and EJ conditions across all of the United States. Similarly, the sections below for each FEMA region address these conditions across a region. These nationwide or region-wide conditions, along with the sample communities in this chapter, provide context for understanding various socioeconomic features of communities that participate in the NFIP.

Naturally, the people, businesses, and assets (such as housing stock) most affected by the NFIP are those within SFHAs. This section provides basic socioeconomic data for SFHAs. Because SFHA boundaries do not match the boundaries of areas used for demographic and economic data, not all of the socioeconomic parameters discussed above can be readily calculated and presented. However, FEMA has conducted the analyses necessary to calculate total population and housing units, as well as the land area, within SFHAs across the nation (Table 3-65).[56] Note that the percentage of the total population and housing units of the United States is in coastal SFHAs (2.3 percent and 2.9 percent, respectively) is higher

[56] Because of the calculation procedures used, total population and housing unit figures do not exactly match 2010 Census data. The data for SFHAs in Table 3-65 and the regional tables represent the 50 States, DC, and Puerto Rico. Housing unit data presented throughout this chapter represent the 50 States, DC, and Puerto Rico. The chapter also includes population and housing unit data for USVI, Guam, Samoa, and the Northern Marianas Islands (as applicable by region).

than the percentage of the total area of the United States within SFHAs (1.7 percent), indicating that development in the nation has been oriented disproportionately toward coastal flood zones. This is not the case for riverine flood zones; however, the population and number of housing units is higher for riverine SFHAs than for coastal SFHAs.

Table 3-65: Area, Population, and Housing Units within SFHAs, United States, 2010

	Within SFHA			
	Coastal	Riverine	Total	U.S. Total
Area (Square Miles)	50,853	228,757	279,610	3,028,504
Percent of U.S. Total Area	1.7%	7.6%	9.2%	100.0%
Population	7,083,405	15,417,626	22,501,031	306,901,422
Percent of U.S. Total Population	2.3%	5.0%	7.3%	100.0%
Housing Units	3,857,103	6,899,297	10,756,400	130,980,270
Percent of U.S. Total Housing Units	2.9%	5.3%	8.2%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.9 Existing Conditions—Flood Insurance Policies and Premiums

Table 3-66 provides flood insurance policies and premiums in the United States compared to FEMA Regions. The average flood insurance coverage in 2015 varied substantially throughout the country, ranging from $186,623 in Region V to $265,176 in Region IX, with a national average of $243,045. The average premium per year ranged from $570 in Region IV to $1,214 in Region I, with a national average of $694.

Table 3-66: Flood Insurance Policies and Premiums in FEMA Regions, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Region I	141,170	$34,677,235,300	$245,642	$171,338,839	$1,214
Region II	433,218	$108,927,595,600	$251,438	$443,338,096	$1,023
Region III	286,333	$65,186,908,400	$227,661	$225,680,531	$788
Region IV	2,415,586	$580,185,628,600	$240,184	$1,377,306,859	$570
Region V	158,510	$29,581,659,400	$186,623	$145,786,459	$920
Region VI	1,089,383	$276,061,019,900	$253,410	$741,755,130	$681
Region VII	59,519	$10,917,511,800	$183,429	$53,697,974	$902
Region VIII	51,563	$12,470,179,000	$241,844	$38,045,320	$738
Region IX	393,961	$104,468,893,600	$265,176	$281,154,110	$714
Region X	79,624	$19,206,139,000	$241,210	$66,986,175	$841
U.S.	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.10 Existing Conditions—Ecosystem Services

Ecosystem services are benefits to the human population derived from natural system functions. In its Millennium Ecosystem Assessment, the United Nations Environmental Program defines four categories of ecosystem services:

- **Provisioning Services:** The provision of food, fresh water, fuel, fiber, and other goods;
- **Regulating Services:** Climate, water, and disease regulation, as well as pollination;
- **Supporting Services:** Soil formation and nutrient cycling; and
- **Cultural Services:** Educational, aesthetic, and cultural heritage values, as well as recreation and tourism (Millennium Ecosystem Assessment, 2005).

Specific ecosystem services include such functions such as erosion control, air and water purification, storm surge protection, flood protection, plant pollination, carbon sequestration, and pest control, among others. These services are derived from natural communities and features, including floodplains, wetlands, forests, estuaries, and grasslands, and from various insects and animals, such as bees and birds. Agricultural lands also provide some ecosystem services. Pasture and hay lands provide many of the same services as natural grasslands. Croplands provide some services but generally at reduced levels compared to natural systems, and croplands can highly compromise some services such as erosion control.

Storm surge protection and flood protection are two ecosystem services that are particularly relevant to the NFIP. Storm surge protection is provided by coastal barrier island and dune systems, including the flora and fauna communities that contribute to the stability of those systems. Coastal wetlands, estuaries, and natural open space also provide this ecosystem service. All these natural systems provide one or more of these functions: blocking storm surges, absorbing and spreading water, and absorbing and attenuating wave energy.

Many natural systems provide flood protection. The soils and vegetation of forests and grasslands prevent or reduce floods by absorbing large portions of the water from rain and snow, allowing this water to flow slowly into streams or percolate downward to recharge groundwater. Wetlands and vegetated floodplains similarly absorb precipitation and runoff, and also slow flowing water, thereby attenuating downstream flood crests. These ecosystems all do this while simultaneously resisting erosion which leads to choking of stream and river channels with sediments, which reduces the conveyance capacity of these channels and leads to heightened flood levels.

A related concept is "green infrastructure," which refers to the use of greenways and distributed best management practices that use vegetation and soils (in both naturally occurring and constructed configurations) to manage rainfall as close to where it falls as possible. Green infrastructure contrasts with traditional stormwater pipe networks, large-scale constructed ponds and reservoirs, and other centralized "gray infrastructure" used to manage runoff and flood waters. As noted by the EPA, "By weaving natural processes into the built environment, green infrastructure provides not only stormwater management, but also flood mitigation, air quality management, and much more" (EPA, 2014). Utilizing ecosystem services is a fundamental characteristic of green infrastructure.

Land use change impacts ecosystem services in two negatively synergistic ways: as development occurs, the need for ecosystem services to mitigate its effects increases, while the area available to provide the necessary ecosystem services decreases. For instance, as urban and suburban development occurs, stormwater runoff increases. There is an increased need for riparian and wetland areas (green infrastructure) to absorb this runoff, but at the same time, these areas are often compromised or lost altogether as development proceeds.

Ecosystem services are not traditionally valued in economic or cost-benefit analyses. Many ecosystem services are not priced in markets, or lack products that are priced in markets. However, some ecosystem services have clear market implications, such as ecosystem provisioning of human food and support of recreational activities. For instance, coastal estuaries and ocean ecosystems supporting commercial and recreational saltwater fishing helped generate more than $199B in sales and supported 1.7 million jobs in the United States in 2011 (NOAA Fisheries, 2012b).

An understanding of the economic value of the functions natural systems provide can improve decision-making. An evaluation of ecosystem services can provide a more comprehensive understanding of the impacts of decisions affecting the natural and built environments. However, at this time, a commonly agreed-upon methodology for determining the economic value of services has not been clearly established (Apitz, 2012). The value of services may vary depending on context and numerous other site- and market-specific factors. Therefore, there is no simple formula to calculate and quantify the value of a service (e.g., water purification from wetlands or carbon sequestration from forests) with the necessary verifiability, reproducibility, and defensibility.

As a result, the ecosystem services subsections for each FEMA region will discuss ecosystem services in a qualitative manner, and associate the services that may be provided with the land cover present. These discussions largely focus on the extent of relatively undisturbed natural areas, which provide high levels of ecosystem services. However, it is important to note that ecosystem services are present even in highly developed areas. For instance, wetlands and undeveloped or lightly developed floodplains within otherwise densely developed areas provide critical water regulation services (flood protection, water purification).

3.12.11 Existing Conditions—Natural Disasters

From 1990 through September 2013, there were approximately 740 major disaster declarations or emergency declarations in the United States involving flooding (FEMA, 2013g). Natural disasters such as flood events can result in significant socioeconomic impacts, including catastrophic losses of life and property, short- and long-term financial and economic impacts, and impacts to perceived and actual quality of life.

Short-term financial and economic impacts resulting from natural disasters include property damage to homes, businesses, and public buildings; costs of emergency response and cleanup; and temporary relocations of a portion of the population or businesses. Short-term impacts also include business interruptions: losses of productivity and income due to property damage, cessation of essential services such as power and water, and losses of customers, including both local customers occupied with the disaster, and non-local customers who stay away from the disaster area for some time. Damages and income losses can be financially devastating, particularly for households and businesses lacking adequate insurance. In addition, local governments may lose revenues due to reductions in tax-generating economic activity or losses to the property tax base. Additional economic and financial impacts may include new or increased needs to mitigate risks from future events because of damages from the recent event. The NFIP covers flood losses to buildings and contents, but it does not protect against the indirect costs of flooding (e.g., temporary housing, loss of business income).

Financial and economic losses from storm and flooding events can be very large when such events hit highly populated and built-up areas. Hurricane Katrina, a Category 5 hurricane that hit New Orleans and the Gulf Coast in 2005, was the costliest natural disaster in United States history, with estimated total damages of $108B, mainly in FEMA Regions IV and VI (Knabb, Tropical Cyclone Report Hurricane Katrina, 2006). The death toll from Hurricane Katrina was 1,200 persons (Blake, Landsea, & Gibney, 2011). Hurricane Sandy, which struck the East Coast in October 2012, was the 2nd costliest hurricane in the United States since 1900, with damages preliminarily estimated at $50B (Blake, Kimberlain, Berg, Cangialosi II, & Beven, 2013) and later estimated at $65B (Rice, 2013).

The Federal government assists with some of the costs of major disaster recovery. For instance, as of one year after Hurricane Sandy, the Federal government had provided the following:

- More than $7.9B in FEMA NFIP payments to policy holders;
- More than $3.2B in FEMA Public Assistance to State, local and Tribal governments for emergency protective measures, debris removal, and repair and replacement of infrastructure in the hardest hit areas;
- More than $2.4B in low-interest disaster loans through the United States Small Business Administration; and
- More than $1.4B in FEMA Individual Assistance grants to more than 182,000 disaster survivors (FEMA, 2013h).

There are no conclusive research findings, particularly with respect to impacts on economic growth, on to the medium- to long-term effects of natural disasters on an economy. Results from some studies have been contradictory (Fang, 2012). Anecdotally, the influx of spending and economic activity that typically accompanies recovery efforts is thought to provide economic stimulus to an area, which may to some degree counteract the short-term economic losses. Also, economic productivity may be increased through the replacement of old infrastructure assets with newer, better infrastructure. These results have been observed in developing countries (Bennett, 2008) (Benson & Clay, 2004). However, it is not clear that these effects are beneficial on a net basis, because in theory, the utilized funds could have been available and put to even more productive use in the absence of the disaster (Kousky, 2013).

There has been relatively little research regarding the long-term economic impacts of natural disasters on the United States economy or United States regional economies. A study for FEMA found that flood events decrease employment at the county level by an average of 3.4 percent, but employment levels recover after one year, on average (Sarmiento & Miller, 2006). Strobl found negative short-term impacts of hurricanes on economic growth at the county level within the first year (the county growth rate decreased by at least 0.45 percentage points), and no impact on growth rates in subsequent years. Strobl also found negligible net effects at the State level within one year, and no effects on the national economy (Strobl, 2008). Another study of United States counties (Deryugina, 2013) found that average earnings are unaffected in the year of the hurricane, but fall by 1.5–3.0 percent in subsequent years, and that the employment rate dips by 0.6–0.7 percent in years 5–8 following the hurricane. Deryugina also found that per capita transfer payments from the government to individuals (primarily unemployment benefits, income maintenance, and public medical spending net of Medicare) increase by 1.9–3.3 percent in years 1–10 following the hurricane, and argues that these payments may have an important role in buffering local economies post-hurricane (Deryugina, 2013). Fang found that climatological and geophysical disasters have a small and negative impact on growth rates at the State level, but that this impact disappears over time. At the county level, Fang found that some disasters (tornados) have a slight but negative impact on per capita gross domestic product levels and growth rates over a five-year period across three States that experience this natural phenomenon. Fang also found evidence that FEMA aid has a small but positive impact on growth and per capita gross domestic product levels at both the county and State level (Fang, 2012).

Floods also affect local government finances. A FEMA-sponsored study found that communities subject to flood hazards hold lower levels of debt than communities that are not subject to flood hazards, which may be explained by the large financial risks associated with flood risks. Conversely, communities that actually experience flooding have higher levels of debt than communities that do not. Probably these communities use debt to offset some of the revenue losses from flood events and recoup costs of recovery. Furthermore, communities that have experienced flood events have lower bond ratings; this is probably attributable to financial stress related to flood events (Sarmiento & Miller, 2006).

3.12.12 Existing Conditions—Public Health and Safety Services

Public health and safety services, such as hospitals, police, and fire services, are a significant factor in the quality of life in a community. There are almost 18,000 State and local law enforcement agencies, 26,434 registered fire departments, and 4,973 registered community hospitals in the 50 States and DC (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013).

Public health and safety services are provided by various professionals and volunteers. Law enforcement agencies and hospitals are staffed primarily by professionals. Fire departments are often staffed by volunteers, and sometimes have completely volunteer forces. The distribution of volunteer fire departments versus "career" or paid professional fire departments varies throughout the country. Some States, like Delaware, have almost exclusively volunteer fire departments, whereas other States, like Hawaii, have a majority of career fire departments. The National Fire Department Census breaks down its data by volunteer or mostly volunteer fire departments, and career or mostly career fire departments. The distinction between volunteer and career fire departments may speak to the availability of local resources to provide services, although this does not mean that volunteer departments are inferior. Also, the distribution of public health and safety services and access for individual communities vary significantly throughout the country, with greater concentrations of services typically available in more densely populated areas.

3.12.13 Existing Conditions—FEMA Regions

To provide a more refined picture of variations in socioeconomic resources across the nation while maintaining a high-level analysis, each of the major characteristics and qualities discussed above are analyzed at the FEMA regional level.

3.12.13.1 FEMA Region I

3.12.13.1.1 Population and Demographic Characteristics

Region I has experienced a slower rate of population growth than the United States as a whole: this region grew only half as fast as the nation from 2010 to 2015. This could be because the area is already home to several older large cities, such as Boston, MA, Hartford, CT, and Providence, RI, and is more established as a whole than other parts of the country that were developed later or are more rural in character. Remaining buildable land is limited in many parts of the region, and the establishment of new industry and new development is also more limited than in other parts of the country. Massachusetts remains the most populous State in the region. New Hampshire was the region's fastest growing State from 2000 to 2010; Massachusetts grew the fastest from 2000 to 2015. Part of Region I is in the "northeast megalopolis," which refers to the large, heavily urbanized area stretching from the northern suburbs of Boston, MA through to the southern suburbs of DC. Table 3-67 details the State-by-State population growth and shows population growth in the region over time.

Table 3-67: Total Population of FEMA Region I by State, 2000 – 2015

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	Total for Region I
Total Population 2000	3,405,565	1,274,923	6,349,097	1,235,786	1,048,319	608,827	13,922,517
Total Population 2010	3,574,097	1,328,361	6,547,629	1,316,470	1,052,567	625,741	14,444,865
Change 2000 – 2010	168,532	53,438	198,532	80,684	4,248	16,914	522,348
AARC 2000 – 2010	0.48%	0.41%	0.31%	0.63%	0.04%	0.27%	0.37%
Total Population 2015	3,590,886	1,329,328	6,794,422	1,330,608	1,056,298	626,042	14,727,584
Change 2010 – 2015	16,789	967	246,793	14,138	3,731	301	282,719
AARC 2010 – 2015	0.09%	0.01%	0.74%	0.21%	0.07%	0.01%	0.39%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The racial and ethnic compositions of Region I have changed somewhat since 2000, with increases in most non-white races and a large increase in the Hispanic population as well. Despite these changes, which are consistent with national demographic trends, Region I remains one of the less diverse areas of the country. All minority group percentages of the region's total population in 2014 were less than the percentages nationally. The age distribution is not substantially different from the United States as a whole. Table 3-68 shows changes in age, racial, and ethnic composition for Region I.

Table 3-68: Age, Racial, and Ethnic Composition of FEMA Region I, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	24.0%	21.8%	20.6%	23.1%	-3.4%
Over 65	13.6%	14.1%	15.6%	14.5%	2.1%
Racial Composition					
White	86.6%	83.0%	82.2%	73.3%	-4.4%
Black or African American	5.2%	6.2%	6.5%	12.6%	1.4%
American Indian or Native Alaskan	0.3%	0.3%	0.3%	0.8%	0.0%
Asian	2.7%	3.9%	4.5%	5.2%	1.8%
Native Hawaiian or Pacific Islander	0.0%	0.0%	0.0%	0.2%	0.0%
Other race	3.2%	4.1%	3.7%	4.8%	0.5%
Two or more races	2.0%	2.4%	2.8%	3.0%	0.8%
Ethnic Composition					
Hispanic or Latino	6.3%	9.0%	10.2%	18.2%	3.9%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Although age distribution is relatively similar among States in Region I, there are substantial differences in racial composition within the region. States that are home to the largest cities in the region, such as Connecticut, Massachusetts, and Rhode Island, show a higher percentage of racial and ethnic minorities, as shown in Table 3-69.

Table 3-69: Age, Racial, and Ethnic Composition of FEMA Region I by State, 2014

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	Total for Region I
2014							
Age							
Under 18	21.5%	19.4%	20.6%	20.1%	20.1%	19.4%	20.6%
Over 65	15.4%	18.2%	15.1%	15.8%	15.8%	17.0%	15.6%
Racial Composition							
White	76.8%	94.8%	79.3%	93.4%	81.3%	94.5%	82.2%
Black or African American	10.3%	1.2%	7.1%	1.3%	6.7%	1.0%	6.5%
American Indian or Native Alaskan	0.2%	0.6%	0.2%	0.2%	0.5%	0.4%	0.3%
Asian	4.2%	1.1%	6.1%	2.6%	3.4%	1.6%	4.5%
Native Hawaiian or Pacific Islander	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	0.1%	<0.1%
Other race	5.5%	0.2%	4.1%	0.5%	5.4%	0.5%	3.7%
Two or more races	2.9%	2.1%	3.1%	2.1%	2.6%	2.1%	2.8%
Ethnic Composition							
Hispanic or Latino	15.0%	1.5%	10.8%	3.2%	14.0%	1.7%	10.2%

Source: (USCB, 2014)

Region I is economically diverse and healthy area overall. Per capita income is higher than the national average. Unemployment and individuals under the poverty line are both lower than the national average. Table 3-70 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-70: Economic Indicators in FEMA Region I, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$36,904	$49,994	$56,798	$46,049	$10,748
Annual Average Unemployment	2.8%	8.4%	5.9%	6.2%	-0.3%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	9.8%	11.2%	11.6%	15.8%	-4.2%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-71 provides figures on employment percentages by industry sector. In 2014, Region I had a considerably higher percentage (two or more percentage points difference) of persons working in "educational services" and "health care and social assistance" than did the nation. It had a somewhat lower percentage of workers in "government and government enterprises" and "administrative and support and waste management and remediation services" and a somewhat higher percentage in "professional, scientific, and technical services" than the nation. In all other industries, Region I had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-71: Employment by Industry Sector for FEMA Region I, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	8,733,988	8,875,022	9,378,271	185,798,800	7.4%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	0.5%	0.5%	0.5%	1.4%	-0.9%
Forestry, fishing, and related activities	0.5%	0.4%	0.4%	0.5%	-0.1%
Mining, quarrying, and oil and gas extraction	0.1%	0.1%	0.1%	0.9%	-0.8%
Utilities	0.4%	0.3%	0.3%	0.3%	0.0%
Construction	5.4%	5.1%	5.3%	5.2%	0.1%
Manufacturing	11.1%	7.2%	6.8%	7.0%	-0.2%
Wholesale trade	3.5%	3.2%	3.1%	3.5%	-0.4%
Retail trade	11.1%	10.3%	10.0%	10.1%	0.0%
Transportation and warehousing	2.4%	2.2%	2.4%	3.4%	-1.0%
Information	2.5%	2.0%	1.9%	1.8%	0.1%
Finance and insurance	5.8%	6.5%	6.3%	5.3%	1.0%
Real estate and rental and leasing	3.0%	4.1%	4.1%	4.4%	-0.3%
Professional, scientific, and technical services	7.3%	7.9%	8.0%	6.9%	1.1%
Management of companies and enterprises	1.4%	1.3%	1.4%	1.3%	0.2%
Administrative and support and waste management and remediation services	5.2%	5.1%	5.2%	6.3%	-1.1%
Educational services	3.5%	4.3%	4.4%	2.4%	2.0%
Health care and social assistance	11.6%	13.6%	13.9%	11.2%	2.7%
Arts, entertainment, and recreation	2.1%	2.4%	2.5%	2.2%	0.3%
Accommodation and food services	6.0%	6.6%	6.9%	7.3%	-0.4%
Other services (except public administration)	4.9%	5.0%	5.2%	5.9%	-0.7%
Government and government enterprises	11.9%	11.9%	11.3%	12.9%	-1.7%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.1.2 Housing Characteristics

Table 3-72 shows key housing indicators for Region I. The total number of housing units grew modestly from 2000 to 2014, compared to the national increase of 15.5 percent. Median home values grew considerably from 2000 to 2014 and in 2014 was somewhat higher in Region I than the national average. Housing occupancy rates and owner-occupancy rates were similar for Region I and the nation.

Table 3-72: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region I, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	5,941,108	6,418,656	6,458,186	135,534,245	8.7%
Median Home Value*	$152,528	$231,184	$239,634	$228,549	57.1%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	90.7%	88.2%	87.4%	87.4%	-3.3%
Percentage of Owner-Occupied Housing Units	64.9%	65.5%	64.7%	63.2%	-0.2%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.1.3 Environmental Justice

Despite the above-average affluence in the region, EJ concerns are relevant in several areas in Region I due to the presence of minority populations or low-income populations (based on the CEQ definitions discussed in Section 3.12.6).[57] At the county level, minority populations account for more than 50 percent of residents in Suffolk County, MA, although additional areas in the region may also contain minority populations based on data at the census tract level. Although Suffolk County is the only county in the region that has a poverty rate above 20 percent, several counties throughout the region are close to 20 percent. In these borderline counties, it is likely that the presence of a relatively small number of very high-income earners may be "masking" the presence of low-income populations when viewed at the county level. (EPA, 2013a)

3.12.13.1.4 Special Flood Hazard Areas

Table 3-73 shows that the population and housing units of Region I are disproportionately outside of both coastal and riverine SFHAs, relative to the area within SFHAs. Although 10.4 percent of the region is located within an SFHA, only 6.7 percent of the population lives within an SFHA and only 7.8 percent of housing units are located there.

[57] This assessment used data obtained through the EPA's EJView tool in October of 2013 (EPA, 2013a). The EPA tool is now known as EJSCREEN (EPA, 2016k). This tool was used for each Region in this analysis.

Table 3-73: Area, Population, and Housing Units within SFHAs in FEMA Region I, 2010

	Within SFHA			Region I
	Coastal	Riverine	Total	Total
Area (Square Miles)	2,530	4,511	7,041	67,557
Percent of Region's Total Area	3.7%	6.7%	10.4%	100.0%
Population	319,166	641,826	960,992	14,446,433
Percent of Region's Total Population	2.2%	4.4%	6.7%	100.0%
Housing Units	199,361	304,155	503,516	6,419,349
Percent of Region's Total Housing Units	3.1%	4.7%	7.8%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.1.5 Flood Insurance Policies and Premiums

Table 3-74 provides figures on flood insurance policies and premiums in Region I compared to the nation. The average flood insurance coverage is substantially the same for Region I compared to the rest of the country. However, the regional average premium per year is significantly higher, almost twice the national average. The average premium per year varies significantly within Region I, ranging from $989 in New Hampshire to $1,335 in Rhode Island.

Table 3-74: Flood Insurance Policies and Premiums in FEMA Region I, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Connecticut	40,660	$10,173,143,300	$250,200	$52,541,493	$1,292
Massachusetts	8,735	$2,013,365,900	$230,494	$9,039,610	$1,035
Maine	63,714	$15,812,217,400	$248,175	$75,593,337	$1,186
New Hampshire	8,862	$1,910,116,700	$215,540	$8,763,997	$989
Rhode Island	15,103	$3,875,805,400	$256,625	$20,169,564	$1,335
Vermont	4,096	$892,586,600	$217,917	$5,230,838	$1,277
Total for Region I	141,170	$34,677,235,300	$245,642	$171,338,839	$1,214
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.1.6 Ecosystem Services

Although Region I contains several large urban centers, there are extensive natural areas that are undisturbed or minimally disturbed, particularly in the northern part of the region. Forests are the dominant land cover in less developed areas, and contribute services such as carbon sequestration, air purification, and nutrient cycling in the environment, as well as providing habitat for various species of fish, wildlife, and insects. Forests, wetlands, and pastures in the region also absorb precipitation and slow runoff, thereby providing flood protection services. (USGS, 2013j)

3.12.13.1.7 Natural Disasters

From 1990 through September 2013, Region I had 79 major disaster declarations and 5 emergency declarations involving flooding. Most flooding events are associated with severe storms, ice jams, snowstorms, and snowmelt events. Hurricane Irene, which coursed along the East Coast in August 2011 and ran north through New England, caused significant losses in Region I. Six deaths due to the storm occurred in the region, and over 2.5 million people experienced power outages. Damages exceeded $1.3B. Vermont was particularly hard-hit due to flash flooding from extreme rainfall. Damages exceeded $730M (Associated Press, 2012). Damage occurred to 500 miles of roads and 200 bridges in the State highway system; to 2,000 road segments, 280 bridges, and 960 culverts across Vermont municipalities; and to numerous other transportation, building, and infrastructure assets (Vermont Agency of Natural Resources, 2012). Recent events include major disaster declarations in New Hampshire and Vermont due to damage from flooding that occurred in late June 2013, and a major disaster declaration in Massachusetts in April 2013 in response to damage from severe winter storms that led to flooding in February 2013. (FEMA, 2013g)

3.12.13.1.8 Public Health and Safety Services

The availability of public health and safety services varies throughout the region, with a greater concentration in the more populous and densely populated States. The Boston Police Department is the largest State or local law enforcement agency in the region and 24th largest in the nation, with more than 2,100 full-time sworn personnel (Bureau of Justice Statistics, 2008). Vermont has the highest percentage (96.9 percent) of volunteer or mostly volunteer fire departments in the region. Conversely, approximately 44 percent of Massachusetts' fire departments are career or mostly career, the highest in the region (FEMA, 2013i). Table 3-75 shows the distribution of public health and safety services throughout the region.

Table 3-75: Public Health and Safety Services, FEMA Region I

	CT	ME	MA	NH	RI	VT	Total for Region I
State & Local Law Enforcement Agencies (2008)	143	146	357	208	48	69	971
Fire Departments (2012)	245	338	359	209	72	194	1,417
Hospitals (2011)	35	37	79	28	11	14	204

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.2 FEMA Region II

3.12.13.2.1 Population and Demographic Characteristics

As in Region I, population growth in Region II was substantially slower than the nation as a whole. New York City, with a population of more than 8 million, is the largest and most densely populated United States city. The New York City metropolitan area constitutes the central portion of the northeast megalopolis. The surrounding urbanized areas in New York and New Jersey are also extensively built-out; as with Region I, other urban centers in the region are older and more established, leaving fewer opportunities for new development and incoming populations than in other parts of the United States. Puerto Rico and USVI have experienced population declines recently. Table 3-76 details State population growth and population growth in the region from 2000 through 2015.

Table 3-76: Total Population of FEMA Region II by State, 2000 – 2015

	New Jersey	New York	Puerto Rico	UVSI	Total for Region II
Total Population 2000	8,414,350	18,976,457	3,808,610	108,612	13,922,517
Total Population 2010	8,791,894	19,378,102	3,725,789	106,405	14,444,865
Change 2000 – 2010	377,544	401,645	(82,821)	(2,207)	522,348
AARC 2000 – 2010	0.44%	0.21%	-0.22%	-0.21%	0.37%
Total Population 2015	8,958,013	19,795,791	3,474,182	106,291	14,727,584
Change 2010 – 2015	166,119	417,689	(251,607)	(114)	282,719
AARC 2010 – 2015	0.38%	0.43%	-1.39%	-0.02%	0.39%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The age distribution within the region is largely consistent with the trends seen at the national level. In terms of racial and ethnic composition, the area is considerably more diverse than the nation as a whole. In particular, the Hispanic population has grown substantially. Table 3-77 shows age, racial, and ethnic composition for Region II, not including the USVI. Data regarding racial and ethnic composition were not available for USVI.

Table 3-77: Age, Racial, and Ethnic Composition of FEMA Region II, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	25.2%	22.9%	21.7%	23.1%	-3.5%
Over 65	12.8%	13.6%	15.0%	14.5%	2.2%
Racial Composition					
White	70.7%	67.7%	65.8%	73.3%	-4.9%
Black or African American	14.3%	14.9%	14.3%	12.6%	0.0%
American Indian or Native Alaskan	0.4%	0.5%	0.3%	0.8%	0.0%
Asian	4.9%	6.7%	7.6%	5.2%	2.7%
Native Hawaiian or Pacific Islander	<0.1%	<0.1%	<0.1%	0.2%	<0.1%
Other race	6.6%	7.2%	8.8%	4.8%	2.3%
Two or more races	3.1%	3.0%	3.1%	3.0%	0.0%
Ethnic Composition					
Hispanic or Latino	24.8%	27.2%	27.7%	18.2%	2.8%

Values do not include the USVI due to missing data.

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

The age distribution is substantially the same within Region II, except that Puerto Rico has a high percentage of its population in the over 65 group. The racial and ethnic composition of the region varies significantly. New York and New Jersey are very similar to each other, whereas Puerto Rico has a much lower percentage of Black or African Americans, higher percentages of "other race" and "two or more races," and ethnically is almost exclusively Hispanic. As mentioned above, Region II is considerably more diverse than the country as a whole. Table 3-78 shows age, racial, and ethnic composition within Region II by State/Territory.

Table 3-78: Age, Racial, and Ethnic Composition of FEMA Region II by State, 2014

	New Jersey	New York	Puerto Rico	USVI	Total for Region II*
2014					
Age					
Under 18	22.5%	21.4%	21.8%	ND	21.7%
Over 65	14.7%	14.7%	17.4%	ND	15.0%
Racial Composition					
White	67.7%	64.0%	71.0%	ND	65.8%
Black or African American	13.6%	15.7%	8.4%	ND	14.3%
American Indian or Native Alaskan	0.2%	0.4%	0.3%	ND	0.3%
Asian	9.3%	8.2%	0.2%	ND	7.6%
Native Hawaiian or Pacific Islander	< 0.1%	< 0.1%	< 0.1%	ND	< 0.1%
Other race	6.9%	8.8%	13.6%	ND	8.8%
Two or more races	2.3%	2.9%	6.4%	ND	3.1%
Ethnic Composition					
Hispanic or Latino	19.3%	18.6%	99.0%	ND	27.7%

ND: No data available.

*Regional values do not include the USVI due to missing data.

Source: (USCB, 2014)

3.12.13.2.2 Economic Characteristics

New York and New Jersey are both very affluent, with per capita income well above the national average. Unemployment and the percentage of individuals below the poverty level are higher than the national averages in 2014. Table 3-79 shows the change over time of per capita income, unemployment, and poverty within Region II (New York and New Jersey), and compares regional to national figures for 2014. Puerto Rico and USVI are not included in this table because data for these territories is limited. However, the available data shows significantly lower per capita income and higher occurrences of poverty and unemployment for these two territories. For instance, in Puerto Rico in 2010, the per capita income was $10,392, annual average unemployment was 17.5 percent, and the poverty rate was 45.1 percent (U.S. Census Bureau, 2010).

Table 3-79: Economic Indicators in FEMA Region II, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$36,507	$49,882	$56,237	$46,049	$10,188
Annual Average Unemployment	4.3%	8.9%	6.4%	6.2%	0.3%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	17.1%	17.2%	18.0%	15.8%	2.1%

Values do not include the USVI due to missing data.

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-80 provides figures on employment percentages by industry sector (New York and New Jersey only). From 2000 to 2014, Region II had slightly slower job growth overall than the national average, attributable at least in part to substantial losses in the manufacturing sector. The region had a considerably lower percentage of workers in manufacturing than did the nation in 2014. Compared to the nation, the region has notably higher percentages (greater than one percentage point difference) of workers in the "finance and insurance" sector and in service-providing sectors, particularly "health care and social assistance," "professional, scientific, and technical services," and "educational services."

Table 3-80: Employment by Industry Sector for FEMA Region II, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	15,130,023	15,899,520	16,929,980	185,798,800	11.9%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	0.5%	0.4%	0.4%	1.4%	-1.0%
Forestry, fishing, and related activities	0.1%	0.1%	0.1%	0.5%	-0.4%
Mining, quarrying, and oil and gas extraction	0.1%	0.1%	0.1%	0.9%	-0.8%
Utilities	0.4%	0.3%	0.3%	0.3%	0.0%
Construction	4.4%	4.2%	4.4%	5.2%	-0.8%
Manufacturing	7.9%	4.7%	4.4%	7.0%	-2.6%
Wholesale trade	4.4%	3.7%	3.6%	3.5%	0.2%
Retail trade	10.2%	9.7%	9.7%	10.1%	-0.3%
Transportation and warehousing	3.5%	3.2%	3.4%	3.4%	0.1%
Information	3.3%	2.4%	2.4%	1.8%	0.6%
Finance and insurance	6.7%	7.1%	7.2%	5.3%	1.9%
Real estate and rental and leasing	3.4%	4.6%	4.7%	4.4%	0.3%
Professional, scientific, and technical services	7.7%	7.9%	8.2%	6.9%	1.3%
Management of companies and enterprises	1.2%	1.4%	1.4%	1.3%	0.2%

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Administrative and support and waste management and remediation services	5.5%	5.3%	5.6%	6.3%	-0.8%
Educational services	2.7%	3.4%	3.5%	2.4%	1.1%
Health care and social assistance	11.4%	13.3%	13.2%	11.2%	2.0%
Arts, entertainment, and recreation	2.2%	2.6%	2.8%	2.2%	0.5%
Accommodation and food services	5.4%	6.0%	6.5%	7.3%	-0.8%
Other services (except public administration)	5.1%	5.5%	5.8%	5.9%	0.0%
Government and government enterprises	13.8%	13.7%	12.3%	12.9%	-0.7%

*Figures may not add to 100% due to rounding
Values do not include the USVI due to missing data.

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.2.3 Housing Characteristics

Table 3-81 (data for New York and New Jersey only) shows key housing indicators for Region II. The total number of housing units grew modestly from 2000 to 2014, compared to the national increase of 15.5 percent. Median home value grew considerably from 2000 to 2014 and in 2014 was considerably higher in Region II than the national average. The occupancy rate is consistent with the national average. The percentage of owner-occupied units is somewhat lower in the region than nationally. This is indicative of an unusually high cost of living in the region, attributable in large part to Manhattan, NY, which has a cost of living that is approximately 125 percent above the national average (DeSenne, 2013).

Table 3-81: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region II, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	12,408,058	13,298,611	13,354,650	135,534,245	7.6%
Median Home Value*	$164,144	$261,632	$262,587	$228,549	60.0%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	91.7%	89.5%	87.7%	87.4%	-4.0%
Percentage of Owner-Occupied Housing Units	58.6%	58.7%	57.4%	63.2%	-1.2%

*Median Home Value represents a simple average of each State's value.
Values do not include USVI due to missing data.

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.2.4 Environmental Justice

As mentioned previously, there is tremendous variation throughout the region regarding wealth and racial and ethnic diversity. As a result, there are several counties with minority populations, as defined by the thresholds described in Section 3.12.6, in and around New York City and southern New Jersey, and all of Puerto Rico. Kings and Bronx Counties, NY both count more than 20 percent of their respective populations as living below the poverty level. For those counties that are close to the threshold, a Census-tract level analysis would likely reveal a higher number of low-income areas that are not easily observable using county-level data. (EPA, 2013a)

3.12.13.2.5 Special Flood Hazard Areas

As shown in Table 3-82, the population and housing units of Region II are disproportionately within coastal SFHAs, and outside of riverine SFHAs, relative to the area within SFHAs. Although only 3.5 percent of the region is located within a coastal SFHA, 4.5 percent of the population and 5.7 percent of the housing units are within a coastal SFHA. Conversely, while 8.1 percent of the region is within a riverine SFHA, only 2.9 percent of the population and 3.2 percent of the housing units are within a riverine SFHA.

Table 3-82: Area, Population, and Housing Units within SFHAs in FEMA Region II, 2010

	Within SFHA			Region II
	Coastal	Riverine	Total	Total
Area (Square Miles)	1,985	4,642	6,627	57,266
Percent of Region's Total Area	3.5%	8.1%	11.6%	100.0%
Population	1,257,225	813,988	2,071,213	28,212,626
Percent of Region's Total Population	4.5%	2.9%	7.3%	100.0%
Housing Units	667,653	372,143	1,039,797	11,683,990
Percent of Region's Total Housing Units	5.7%	3.2%	8.9%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.2.6 Flood Insurance Policies and Premiums

Table 3-83 provides figures on flood insurance policies and premiums in Region II compared to the nation. The average flood insurance coverage varies considerably within Region II, ranging from $142,410 in Puerto Rico to $266,590 in New York. The regional average premium per year is well above the national average, and ranges from $811 in Puerto Rico to $1,232 in the USVI.

Table 3-83: Flood Insurance Policies and Premiums in FEMA Region II, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
New Jersey	233,780	$57,071,260,800	$244,124	$230,468,695	$986
New York	188,202	$50,172,713,800	$266,590	$203,078,135	$1,079
Puerto Rico	9,615	$1,369,268,500	$142,410	$7,794,554	$811
USVI	1,621	$314,352,500	$193,925	$1,996,712	$1,232
Total for Region II	433,218	$108,927,595,600	$251,438	$443,338,096	$1,023
U.S.	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.2.7 Ecosystem Services

Despite the densely developed areas around New York City, NY; Camden, NJ; Buffalo, NY; and other urban areas, upstate New York, southern New Jersey, Puerto Rico, and USVI have relatively expansive areas that are less developed, with undisturbed natural resources. Upstate New York is characterized by substantial forest cover as well as woody wetlands and agricultural areas, and southern New Jersey has extensive wetland areas as part of its coastal barrier island complex and the shoreline around the Delaware Bay. Puerto Rico is home to the only tropical forests in the USFS system, with mangrove swamps, coastal wetlands and marshes, as well as interior upland forests (USGS, 2013j). These natural systems provide air and water purification, carbon sequestration, nutrient cycling, stormwater storage, storm and flooding abatement, erosion control, and storm surge protection, and provide habitat for a wide range of fish, wildlife, and insects.

3.12.13.2.8 Natural Disasters

From 1990 through September 2013, Region II had 43 major disaster declarations involving flooding. Flooding has typically been associated with severe storms, coastal storms, heavy rains, landslides, mudslides, and tropical storms or hurricanes. Region II has been subject to direct landfall of several major storms in recent years that have caused significant damage, exacerbated by intensive coastal zone development. Hurricane Sandy, which struck in October 2012, caused an estimated $65B in damages (Rice, 2013). The cost of the storm reflects both its size and extent (it affected several other FEMA regions as well), and reflects the nature of impacts from a storm striking a large, densely urbanized area with extensive housing development, infrastructure, and transit systems. New Jersey was particularly hard-hit by Hurricane Sandy.

In addition to hurricanes, the region is subject to nor'easters, storms accompanied by high winds, coastal flooding, and blizzard conditions. Although they can occur year-round, nor'easters are most severe in winter and often produce heavy snow and rain, as well as wave action that can result in coastal erosion and damage to the built environment (National Weather Service, 2009a). These damages affect all coastal-dependent activities, including industry, transportation, and shipping facilities, as well as recreation and tourism.

Puerto Rico and USVI are also susceptible to damage from major storms as they lie directly in the path of many tropical storms and hurricanes, which occur primarily from June through November. With little protection due to relatively low topography on the islands, storm events as well as anthropogenic activities, including agriculture and urban development, have resulted in erosion and loss of coastal marshes and sand dunes, and the associated flood protection services that they previously provided. In 1989, Hurricane Hugo, a Category 4 storm, made landfall in St. Croix, the island of Vieques, and the eastern side of Puerto Rico. Sustained winds of 140 mph caused substantial damage and approximately 80 percent of houses in the storm areas were either damaged or destroyed (The Puerto Rico Hurricane Center, Undated). Hurricane Hugo's storm surge reached a height of 2 to 3 feet on St. Croix, with waves 20 to 23 feet high (Masters, Undated).

Other recent events include major disaster declarations in New York in July 2013 due to severe storms and flooding, in New Jersey in September 2011 due to severe storms and flooding, and in Puerto Rico in July 2011 for flooding and landslides. (FEMA, 2013g)

3.12.13.2.9 Public Health and Safety Services

At the time of writing, data are not available on public health and safety services in Puerto Rico and USVI. There are a large number of public health and safety services available in New York and New Jersey, likely attributable to the high population density in both States. The New York City Police Department is the largest State or local law enforcement agency in the country, with more than 36,000 full-time sworn personnel (Bureau of Justice Statistics, 2011). Fire departments in New York and New Jersey are predominantly volunteer-based or mostly volunteer-based, 94.6 percent and 89.1 percent, respectively (FEMA, 2013i). Table 3-84 shows the distribution of public health and safety services throughout the region.

Table 3-84: Public Health and Safety Services, FEMA Region II

	New Jersey	New York	Total for Region II
State & Local Law Enforcement Agencies (2008)	550	514	**1,064**
Fire Departments (2012)	689	1,610	**2,299**
Hospitals (2011)	73	182	**255**

Puerto Rico and USVI were not included; data is not available.

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.3 FEMA Region III

3.12.13.3.1 Population and Demographic Characteristics

Population growth in Region III has been slower than the national average, although it does exceed the rate in Regions I and II. The region's northern cities of Philadelphia, PA; Baltimore, MD; and Washington, DC constitute the southern end of the northeast megalopolis. As a result, the northern part of Region III is more heavily populated, while the southern portion is less developed and has a greater capacity for growth.

Table 3-85 shows population growth in the region over time.

Table 3-85: Total Population of FEMA Region III by State, 2000 – 2015

	Delaware	DC	Maryland	Pennsylvania	Virginia	West Virginia	Total for Region III
Total Population 2000	783,600	572,059	5,296,486	12,281,054	7,078,515	1,808,344	27,820,058
Total Population 2010	897,934	601,723	5,773,552	12,702,379	8,001,024	1,852,994	29,829,606
Change 2000 – 2010	114334	29,664	477,066	421,325	922,509	44,650	2,009,548
AARC 2000 – 2010	1.37%	0.51%	0.87%	0.34%	1.23%	0.24%	0.70%
Total Population 2015	945,934	672,228	6,006,401	12,802,503	8,382,993	1,844,128	30,654,187
Change 2010 – 2015	48,000	70,505	232,849	100,124	381,969	(8,866)	824,581
AARC 2010 – 2015	1.05%	2.24%	0.79%	0.16%	0.94%	-0.10%	0.55%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The age distribution in Region III is largely similar to the United States national average. Racial and ethnic diversity is also similar to the national average, except that the percentage of the Black or African American population is considerably larger, and the percentage of the Hispanic population is considerably less than in the nation as a whole. The region has seen a larger percentage point decrease in the white population as a percentage of the total population than seen in the nation, and a somewhat lower increase in the Hispanic population. The States differ considerably in their racial and ethnic composition. In DC, the white population is only 40.2 percent of the total population. Table 3-86 and Table 3-87 show the age, racial, and ethnic composition of Region III as a whole and by State.

Table 3-86: Age, Racial, and Ethnic Composition of FEMA Region III, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	24.2%	22.4%	21.7%	23.1%	-2.5%
Over 65	13.5%	13.9%	15.3%	14.5%	1.7%
Racial Composition					
White	77.2%	73.2%	72.8%	73.3%	-4.4%
Black or African American	16.7%	17.4%	17.6%	12.6%	0.9%
American Indian or Native Alaskan	0.2%	0.3%	0.2%	0.8%	<0.1%
Asian	2.6%	3.9%	4.4%	5.2%	1.8%
Native Hawaiian or Pacific Islander	<0.1%	<0.1%	<0.1%	0.2%	0.0%
Other race	1.7%	2.8%	2.2%	4.8%	0.6%
Two or more races	1.5%	2.4%	2.6%	3.0%	1.1%
Ethnic Composition					
Hispanic or Latino	3.8%	6.6%	7.5%	18.2%	3.8%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Table 3-87: Age, Racial, and Ethnic Composition of FEMA Region III by State, 2014

	Delaware	DC	Maryland	Pennsylvania	Virginia	West Virginia	Total for Region III
2014							
Age							
Under 18	21.8%	17.5%	22.6%	21.1%	22.4%	20.7%	21.7%
Over 65	16.4%	11.3%	13.8%	16.7%	13.8%	17.8%	15.3%
Racial Composition							
White	69.2%	40.2%	57.4%	81.4%	68.9%	93.6%	72.8%
Black or African American	21.7%	48.8%	29.7%	11.1%	19.2%	3.7%	17.6%
American Indian or Native Alaskan	0.4%	0.3%	0.2%	0.2%	0.3%	0.2%	0.2%
Asian	3.9%	3.8%	6.2%	3.1%	6.1%	0.6%	4.4%
Native Hawaiian or Pacific Islander	<0.1%	<0.1%	<0.1%	<0.1%	0.1%	<0.1%	<0.1%
Other race	2.2%	4.4%	3.5%	1.9%	2.1%	0.2%	2.2%
Two or more races	2.6%	2.5%	2.9%	2.3%	3.3%	1.7%	2.6%
Ethnic Composition							
Hispanic or Latino	8.9%	10.4%	9.3%	6.5%	8.8%	1.3%	7.5%

Source: (USCB, 2014)

3.12.13.3.2 Economic Characteristics

Similar to Regions I and II, which form the northern and central portions of the northeast megalopolis, respectively, per capita income in Region III is higher than the national average. Unemployment and poverty are slightly lower than the average. Table 3-88 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-88: Economic Indicators in FEMA Region III, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$31,684	$44,189	$49,416	$46,049	$3,367
Annual Average Unemployment	3.7%	8.0%	5.7%	6.2%	-0.5%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	10.7%	12.5%	12.8%	15.8%	-3.1%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-89 provides figures on employment percentages by industry sector. In 2014, Region III had a somewhat lower share of workers in "manufacturing" compared to the rest of the country, and somewhat higher shares in "professional, scientific, and technical services," and "government and government enterprises." The latter is probably due to the Federal government being headquartered in Washington, DC. In all other industries, Region III had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-89: Employment by Industry Sector for FEMA Region III, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	16,489,603	17,429,023	18,193,300	185,798,800	10.3%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	1.2%	1.0%	0.9%	1.4%	-0.5%
Forestry, fishing, and related activities	0.3%	0.2%	0.2%	0.5%	-0.3%
Mining, quarrying, and oil and gas extraction	0.4%	0.6%	0.7%	0.9%	-0.2%
Utilities	0.4%	0.3%	0.3%	0.3%	0.0%
Construction	5.7%	5.3%	5.3%	5.2%	0.1%
Manufacturing	9.4%	5.9%	5.7%	7.0%	-1.3%
Wholesale trade	3.1%	2.9%	2.8%	3.5%	-0.7%
Retail trade	11.2%	10.0%	9.9%	10.1%	-0.1%
Transportation and warehousing	3.1%	3.0%	3.2%	3.4%	-0.2%
Information	2.4%	1.7%	1.5%	1.8%	-0.2%
Finance and insurance	4.5%	4.8%	4.9%	5.3%	-0.4%
Real estate and rental and leasing	2.9%	3.9%	3.8%	4.4%	-0.5%
Professional, scientific, and technical services	7.4%	8.6%	8.6%	6.9%	1.7%
Management of companies and enterprises	1.0%	1.4%	1.4%	1.3%	0.2%
Administrative and support and waste management and remediation services	5.5%	5.4%	5.7%	6.3%	-0.6%
Educational services	2.4%	3.1%	3.1%	2.4%	0.7%
Health care and social assistance	10.0%	11.9%	12.1%	11.2%	0.9%
Arts, entertainment, and recreation	1.8%	2.1%	2.2%	2.2%	-0.1%
Accommodation and food services	6.0%	6.5%	6.8%	7.3%	-0.5%
Other services (except public administration)	5.8%	5.8%	6.0%	5.9%	0.1%
Government and government enterprises	15.6%	15.8%	14.8%	12.9%	1.9%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.3.3 Housing Characteristics

Table 3-90 shows key housing indicators for Region III. Consistent with other growth trends in this region, as well as growth trends in Regions I and II, the total number of housing units grew substantially from 2000 to 2014, but less than the national increase of 15.5 percent. Median home value grew considerably from 2000 to 2014. In 2014, the median home value was considerably higher in Region III than in the nation, reflecting the affluence of the area, consistent with the above-average per capita income. Housing occupancy rates and owner-occupancy rates were similar for Region III and the nation in 2014.

Table 3-90: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region III, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	11,761,765	12,895,589	13,067,785	135,534,245	11.1%
Median Home Value*	$127,362	$229,664	$265,802	$228,549	108.7%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	91.3%	90.0%	88.4%	87.4%	-2.9%
Percentage of Owner-Occupied Housing Units	69.4%	68.3%	66.9%	63.2%	-2.5%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.3.4 Environmental Justice

There are a number of counties surrounding and including DC; Baltimore, MD; and Philadelphia, PA that have minority populations in excess of 50 percent, as well as a cluster of counties in southern Virginia on the border with North Carolina. In addition, there are several counties with a poverty rate of 20 percent or higher, including Baltimore County, MD; Philadelphia County, PA; the city of Richmond, VA; Petersburg City, VA; and Gilmer and Monongalia Counties, WV. These counties, and possibly others as well, may have potential EJ communities at the sub-county level.

3.12.13.3.5 Special Flood Hazard Areas

The population and housing units of Region III are disproportionately outside of both coastal and riverine SFHAs, relative to the area within SFHAs (Table 3-91). Although 9.1 percent of the region is located within an SFHA, only 5.2 percent of the population and 5.8 percent of the housing units are located there.

Table 3-91: Area, Population, and Housing Units within SFHAs in FEMA Region III, 2010

	Within SFHA			Region III
	Coastal	Riverine	Total	Total
Area (Square Miles)	4,304	7,011	11,315	123,822
Percent of Region's Total Area	3.5%	5.7%	9.1%	100.0%
Population	333,198	1,225,983	1,559,181	30,038,342
Percent of Region's Total Population	1.1%	4.1%	5.2%	100.0%
Housing Units	187,284	566,388	753,672	12,995,956
Percent of Region's Total Housing Units	1.4%	4.4%	5.8%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.3.6 Flood Insurance Policies and Premiums

Table 3-92 provides figures on flood insurance policies and premiums in Region III compared to the nation. The average flood insurance coverage varies considerably within Region III, ranging from

$141,146 in West Virginia to $255,237 in Delaware. The regional average premium per year ranges from $593 in Maryland to $1,062 in Pennsylvania, compared to a national average of $694.

Table 3-92: Flood Insurance Policies and Premiums in FEMA Region III, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Delaware	26,843	$6,851,337,800	$255,237	$19,254,988	$717
District of Columbia	2,145	$472,064,100	$220,077	$1,406,670	$656
Maryland	69,040	$15,766,786,100	$228,372	$40,952,188	$593
Pennsylvania	65,406	$13,032,569,700	$199,256	$69,457,634	$1,062
Virginia	105,072	$26,547,949,700	$252,664	$77,220,381	$735
West Virginia	17,827	$2,516,201,000	$141,146	$17,388,670	$975
Total Region III	286,333	$65,186,908,400	$227,661	$225,680,531	$788
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.3.7 Ecosystem Services

Despite the presence of several major cities, there are still large areas of undisturbed areas in Region III, particularly in the central portion. Mixed and deciduous forest cover is predominant, particularly in West Virginia, as well as extensive wetland and marsh areas in and around the Chesapeake Bay and its tributaries. Toward the southern portion of the region, cultivated crops and pastureland are also more common (USGS, 2013j). In addition to providing habitat for a wide range of animals and insects, these systems perform such valuable services as nutrient cycling, air and water purification, carbon sequestration, storm surge protection, flood protection, groundwater recharge, and erosion control.

3.12.13.3.8 Natural Disasters

From 1990 through September 2013, Region III had 60 major disaster declarations involving flooding. Flooding has typically been associated with severe storms, landslides, tornadoes, and tropical storms or hurricanes. Hurricane Irene, in August 2011, was one of the more damaging storms in recent years. It caused at least 16 deaths and $816M in damages in the region (Associated Press, 2012). Hurricane Sandy, described under Region II, also severely impacted Region III. Other recent events include major disaster declarations in West Virginia in July 2013 due to severe storms and flooding, and two declarations in West Virginia in March 2012 due to flooding, landslides, and tornadoes (FEMA, 2013g).

3.12.13.3.9 Public Health and Safety Services

Region III has a highly varied population density, from central areas of well-established cities such as DC; Baltimore, MD; and Philadelphia, PA to rural Appalachian mountain areas. The services available in different communities vary according to population density and distribution. The DC Metropolitan Police Department is the largest State or local law enforcement agency in the region, and the 11th largest in the nation with more than 3,700 full-time sworn personnel (Bureau of Justice Statistics, 2011). Delaware has the largest percentage of volunteer fire departments in the country, with 98 percent of all registered departments in the State categorized as volunteer or mostly volunteer. By contrast, 100 percent of registered fire departments in DC are career or mostly career (FEMA, 2013i). Table 3-93 shows the distribution of public services within the area.

Table 3-93: Public Health and Safety Services, Region III

	Delaware	District of Columbia	Maryland	Pennsylvania	Virginia	West Virginia	Total for Region III
State & Local Law Enforcement Agencies (2008)	50	4	142	1,117	340	233	**1,886**
Fire Departments (2012)	58	3	263	1,800	521	396	**3,041**
Hospitals (2011)	7	11	48	194	89	55	**404**

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.4 FEMA Region IV

3.12.13.4.1 Population and Demographic Characteristics

Region IV encompasses a large and diverse area with eight States covering the southeast portion of the country. Population growth within Region IV has been strong with the growth rate exceeding the national average between 2000 and 2015. Florida, Georgia, North Carolina, and South Carolina, home to some of the region's largest cities, have seen the strongest growth. This has been characteristic of an overall trend of migration to southern States, referred to as the "Sun Belt" due to the lower cost of living, lower taxes, and more available land for development (Kotkin, 2011). The Sun Belt includes the area from the Carolinas south to Florida and west to California (Kotkin, 2011). Region IV includes the eastern portion of the Sun Belt. Table 3-94 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Table 3-94: Total Population of FEMA Region IV by State, 2000 – 2015

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee	Total for Region IV
Total Population 2000	4,447,100	15,982,378	8,186,453	4,041,769	2,844,658	8,049,313	4,012,012	5,689,283	**53,252,966**
Total Population 2010	4,779,736	18,801,310	9,687,653	4,339,367	2,967,297	9,535,483	4,625,364	6,346,105	**61,082,315**
Change 2000 – 2010	332,636	2,818,932	1,501,200	297,598	122,639	1,486,170	613,352	656,822	**7,829,349**
AARC 2000 – 2010	0.72%	1.64%	1.70%	0.71%	0.42%	1.71%	1.43%	1.10%	**1.38%**
Total Population 2015	4,858,979	20,271,272	10,214,860	4,425,092	2,992,333	10,042,802	4,896,146	6,600,299	**64,301,783**
Change 2010 – 2015	79,243	1,469,962	527,207	85,725	25,036	507,319	270,782	254,194	**3,219,468**
AARC 2010 – 2015	0.33%	1.52%	1.07%	0.39%	0.17%	1.04%	1.14%	0.79%	**1.03%**

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The age distribution of the population is not substantially different from the country as a whole, although the percentage of the population over the age of 65 is slightly higher. As a percentage of the total population, the African American population is substantially higher in Region IV than in the nation as a whole; percentages of other racial groups and the Hispanic population are significantly less than the national averages. However, the percentage of Hispanic population is substantially higher in Florida than nationally. Table 3-95 and Table 3-96 show the age, racial, and ethnic composition for Region IV as a whole, and by State, respectively.

Table 3-95: Age, Racial, and Ethnic Composition of FEMA Region IV, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	24.6%	23.4%	22.4%	23.1%	-2.1%
Over 65	13.5%	14.1%	15.8%	14.5%	2.4%
Racial Composition					
White	74.0%	70.8%	71.3%	73.3%	-2.7%
Black or African American	20.7%	21.3%	21.6%	12.6%	0.9%
American Indian or Native Alaskan	0.5%	0.5%	0.4%	0.8%	<0.1%
Asian	1.4%	2.1%	2.3%	5.2%	0.9%
Native Hawaiian or Pacific Islander	<0.1%	0.1%	0.1%	0.2%	<0.1%
Other race	1.9%	3.2%	2.2%	4.8%	0.3%
Two or more races	1.5%	2.1%	2.2%	3.0%	0.6%
Ethnic Composition					
Hispanic or Latino	7.3%	11.1%	12.0%	18.2%	4.6%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Table 3-96: Age, Racial, and Ethnic Composition of FEMA Region IV by State, 2014

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee	Total for Region IV
2014									
Age									
Under 18	22.9%	20.4%	24.7%	23.0%	24.5%	23.0%	22.4%	22.8%	22.4%
Over 65	15.4%	19.1%	12.4%	14.8%	14.3%	14.7%	15.8%	15.1%	15.8%
Racial Composition									
White	68.5%	76.0%	59.9%	87.4%	58.8%	69.1%	67.3%	77.6%	71.3%
Black or African American	26.6%	16.2%	31.3%	7.9%	37.8%	21.7%	27.3%	16.9%	21.6%
American Indian or Native Alaskan	0.5%	0.3%	0.3%	0.2%	0.4%	1.1%	0.3%	0.3%	0.4%
Asian	1.2%	2.6%	3.7%	1.2%	0.8%	2.5%	1.4%	1.6%	2.3%
Native Hawaiian or Pacific Islander	0.0%	0.1%	0.1%	0.1%	<0.1%	0.1%	0.1%	0.1%	0.1%
Other race	1.4%	2.5%	2.8%	1.0%	0.8%	3.2%	1.4%	1.5%	2.2%
Two or more races	1.8%	2.4%	2.0%	2.1%	1.3%	2.4%	2.1%	2.1%	2.2%
Ethnic Composition									
Hispanic or Latino	4.0%	24.1%	9.1%	3.3%	2.7%	9.0%	5.3%	4.9%	12.0%

Source: (USCB, 2014)

3.12.13.4.2 Economic Characteristics

Per capita income has grown more slowly in Region IV than the rest of the country, and remains considerably below the national average. Unemployment and the percentage of individuals below the poverty level in 2014 are higher than the national averages. Table 3-97 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-97: Economic Indicators in FEMA Region IV, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$27,447	$35,631	$39,726	$46,049	-$6,323
Annual Average Unemployment	3.9%	10.7%	6.6%	6.2%	0.4%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	13.7%	17.8%	17.8%	15.8%	2.0%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-98 provides figures on employment percentages by industry sector. The distribution of jobs across industry sectors in Region IV in 2014 was largely the same as it was in the country as a whole. Region IV had a somewhat higher percentage of workers in the "administrative and support and waste management and remediation services" sector than the nation. It had a somewhat lower percentage of persons working in the "health care and social assistance" sector than the nation. In all other sectors, Region IV had relatively similar percentages of employment (within one percentage point) compared to the nation.

Table 3-98: Employment by Industry Sector for FEMA Region IV, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	30,602,701	32,468,062	35,000,164	185,798,800	14.4%
Farm employment	2.0%	1.5%	1.4%	1.4%	-0.1%
Forestry, fishing, and related activities	0.6%	0.5%	0.5%	0.5%	0.0%
Mining, quarrying, and oil and gas extraction	0.2%	0.3%	0.4%	0.9%	-0.6%
Utilities	0.4%	0.3%	0.3%	0.3%	0.0%
Construction	6.4%	5.3%	5.3%	5.2%	0.1%
Manufacturing	11.5%	7.0%	7.1%	7.0%	0.1%
Wholesale trade	3.8%	3.5%	3.4%	3.5%	<0.1%
Retail trade	11.7%	10.7%	10.7%	10.1%	0.6%
Transportation and warehousing	3.5%	3.3%	3.5%	3.4%	0.2%
Information	2.1%	1.6%	1.6%	1.8%	-0.2%
Finance and insurance	4.1%	4.8%	4.9%	5.3%	-0.4%
Real estate and rental and leasing	3.3%	4.7%	4.7%	4.4%	0.3%
Professional, scientific, and technical services	4.9%	5.9%	6.0%	6.9%	-0.9%

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Management of companies and enterprises	0.9%	1.0%	1.1%	1.3%	-0.2%
Administrative and support and waste management and remediation services	7.2%	7.1%	7.5%	6.3%	1.2%
Educational services	1.2%	1.9%	1.9%	2.4%	-0.4%
Health care and social assistance	8.0%	10.2%	10.1%	11.2%	-1.1%
Arts, entertainment, and recreation	1.8%	2.1%	2.2%	2.2%	0.0%
Accommodation and food services	6.6%	7.4%	7.8%	7.3%	0.6%
Other services (except public administration)	5.5%	6.0%	6.4%	5.9%	0.5%
Government and government enterprises	14.2%	14.8%	13.3%	12.9%	0.4%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.4.3 Housing Characteristics

Table 3-99 shows key housing indicators for Region IV. The total number of housing units grew considerably from 2000 to 2014 (more than the national increase of 15.5 percent), which is consistent with the region's population growth trend. Median home values in the region grew only modestly and in 2014 were considerably lower than the national average, indicating that the region has an overall lower cost of living. Occupancy and home ownership rates are similar to national rates. However, Florida was particularly hard hit by the foreclosure crisis, with 11 of its top 25 cities ranked as the worst for foreclosure in 2010 (Brennan, 2011).

Table 3-99: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region IV, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	23,178,332	27,729,461	28,259,450	135,534,245	21.9%
Median Home Value*	$103,851	$131,619	$144,015	$228,549	38.7%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	89.0%	85.7%	83.8%	87.4%	-5.1%
Percentage of Owner-Occupied Housing Units	70.1%	67.6%	64.9%	63.2%	-5.2%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.4.4 Environmental Justice

There are a large number of counties within the region with a minority population in excess of 50 percent—they extend through large areas of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee, particularly along the Mississippi River. Furthermore, many of the same counties also have a poverty rate above 20 percent, indicating a high potential for EJ concerns in these areas. There is also a large area of counties with high poverty rates concentrated in eastern Kentucky, where EJ concerns may be an issue as well. (EPA, 2013a)

3.12.13.4.5 Special Flood Hazard Areas

As shown in Table 3-100, the population and housing units of Region IV are disproportionately outside of both coastal and riverine SFHAs, relative to the area within SFHAs. Although 21.3 percent of the region is located within an SFHA, only 13.8 percent of the population lives within an SFHA and only 15.5 percent of housing units are located there.

Table 3-100: Area, Population, and Housing Units within SFHAs in FEMA Region IV, 2010

	Within SFHA			Region IV
	Coastal	Riverine	Total	Total
Area (Square Miles)	18,680	62,942	81,622	383,823
Percent of Region's Total Area	4.9%	16.4%	21.3%	100.0%
Population	3,582,199	4,873,382	8,455,581	61,088,849
Percent of Region's Total Population	5.9%	8.0%	13.8%	100.0%
Housing Units	2,059,689	2,240,221	4,299,910	27,732,354
Percent of Region's Total Housing Units	7.4%	8.1%	15.5%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.4.6 Flood Insurance Policies and Premiums

Table 3-101 provides figures on flood insurance policies and premiums in Region IV compared to the nation. The average flood insurance coverage within Region IV is similar to the national average, although the average coverage in Kentucky is considerably less ($161,125 compared to $243,045). The average premium per year varies slightly within Region IV, ranging from $524 in Florida to $856 in Kentucky, all relatively close to the national average of $694 per year.

Table 3-101: Flood Insurance Policies and Premiums in FEMA Region IV, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Alabama	55,264	$12,286,705,700	$222,327	$35,681,868	$646
Florida	1,821,916	$436,270,769,600	$239,457	$955,406,852	$524
Georgia	88,735	$22,637,302,900	$255,111	$66,186,215	$746
Kentucky	22,798	$3,673,317,700	$161,125	$19,524,415	$856
Mississippi	66,442	$15,625,839,100	$235,180	$41,919,911	$631
North Carolina	130,007	$31,645,296,100	$243,412	$102,889,826	$791
South Carolina	200,082	$51,059,320,900	$255,192	$132,024,359	$660
Tennessee	30,342	$6,987,076,600	$230,277	$23,673,413	$780
Total for Region IV	2,415,586	$580,185,628,600	$240,184	$1,377,306,859	$570
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.4.7 Ecosystem Services

One of the prominent physical features of the eastern portion of Region IV is the coastal barrier island complex along the Atlantic Ocean, and the vast wetlands that include the Atlantic and Gulf Coast areas. The interior of the region is characterized by a mix of forest cover and agricultural land, with cultivated crops seen more commonly along the Mississippi River (USGS, 2013j). These natural and agricultural systems provide important services such as flood protection, storm surge protection, shoreline stabilization, air and water purification, groundwater recharge, erosion control, and carbon sequestration, in addition to habitat for animals and insects.

3.12.13.4.8 Natural Disasters

From 1990 through September 2013, Region IV had 118 major disaster declarations and 2 emergency declarations involving flooding. Flooding events are typically associated with tornadoes, severe storms, tropical storms or hurricanes, and straight-line winds. The annual Atlantic hurricane season begins June 1 and ends November 30. While East Coast hurricanes and tropical storms have made landfall all along the eastern seaboard, including up through the mid-Atlantic and New England regions, the southern Atlantic coast and Gulf coast areas are hit with greater frequency, resulting in more frequent losses of life and property (National Hurricane Center, 2012). Some areas (e.g., the Big Bend area of Florida) are especially vulnerable because of a wide, shallow continental shelf and low-lying upland areas. In addition, Florida has a disproportionately high number of tornadoes annually due to its frequent thunderstorm activity. (NCDC, 2013)

Development, dredging, and levee construction in the region have resulted in the loss of coastal marshes and the associated flood protection services they provide. This has contributed to many billions of dollars of damages in Florida from hurricane events, including Hurricanes Andrew in 1992, Ivan and Charlie in 2004, and Wilma in 2005, which caused damages of $52.3B, $15.5B, $16.3B, and $20.6B, respectively (all in 2005 dollars) (Malmstadt, 2009). Georgia and South Carolina are also susceptible to hurricane-related damage, but have been fortunate that a major storm event has not made landfall since Hurricane David hit the Georgia coast in 1979. Hurricane David caused $320M dollars in damage and killed 15 people in the continental United States, after causing much more extensive damage in the Dominican Republic (Hebert, 1980). Hurricane Floyd hit the coast of North Carolina in September 1999 and tracked up through the East Coast, killing 56 people and causing $6.9B in damage along its path (Blake, Landsea, & Gibney, 2011). In North Carolina, rainfall from Hurricane Floyd exceeded 20 inches in some areas. Many rivers were already flooded from the rains of Hurricane Dennis two weeks earlier. With Hurricane Floyd's additional rainfall, several locations in the State experienced greater than 500-year flooding. Thirty-five people died and damages exceeded $3B, with over 7,000 homes destroyed and 56,000 homes damaged (National Weather Service, 2000). Tennessee and Kentucky experienced a severe rainfall and flooding event in early May 2010, resulting in 26 fatalities and over $2B in damages in the greater Nashville area alone (National Weather Service, 2011).

In 2005, Hurricane Katrina—a Category 5 hurricane—had a storm surge that reached a height of 28 feet east of the Bay of St. Louis (Hancock County, MS) and extended 6 miles inland, up to 12 miles inland along bays and rivers (The White House (President George W. Bush), Undated). Hurricane Katrina was the costliest natural disaster in the United States with total property damage estimates of $81B, mainly in FEMA Regions IV and VI. (Knabb, Tropical Cyclone Report Hurricane Katrina, 2006)

Other recent events include major disaster declarations in Florida in August 2013 for severe storms and flooding and in October 2012 for Hurricane Isaac relief. There was an additional declaration in February 2013 in Mississippi due to severe storms, tornadoes, and flooding (U.S. Society on Dams, Undated).

3.12.13.4.9 Public Health and Safety Services

Despite the relatively rural nature of large portions of Region IV, there are a large number of public health and safety services available throughout the region. The Miami-Dade, Florida Police Department is the largest law enforcement department in the region, and the 15th largest nationally (Bureau of Justice Statistics, 2011). Table 3-102 shows the distribution of law enforcement, fire, and hospital services by State.

Table 3-102: Public Health and Safety Services, Region IV

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee	Total Region IV
State & Local Law Enforcement Agencies (2008)	417	387	628	389	342	504	272	375	**3,314**
Fire Departments (2012)	769	477	461	676	414	1,016	433	615	**4,861**
Hospitals (2011)	102	213	153	106	99	117	66	133	**989**

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.5 FEMA Region V

3.12.13.5.1 Population and Demographic Characteristics

Population growth in Region V has been considerably slower than in the nation as a whole, at a rate of much less than half the national average. As with Regions I and II, this may be partly attributable to domestic migration toward the Sun Belt States. The Sun Belt States have seen steady or accelerated growth while the rate of growth in northern States, including States in Region V, has declined. Table 3-103 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Table 3-103: Total Population of FEMA Region V by State, 2000 – 2015

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin	Total for Region V
Total Population 2000	12,419,293	6,080,485	9,938,444	4,919,479	11,353,140	5,363,675	50,074,516
Total Population 2010	12,830,632	6,483,802	9,883,640	5,303,925	11,536,504	5,686,986	51,725,489
Change 2000 – 2010	411,339	403,317	-54,804	384,446	183,364	323,311	1,650,973
AARC 2000 – 2010	0.33%	0.64%	-0.06%	0.76%	0.16%	0.59%	0.32%
Total Population 2015	12,859,995	6,619,680	9,922,576	5,489,594	11,613,423	5,771,337	52,276,605
Change 2010 – 2015	29,363	135,878	38,936	185,669	76,919	84,351	551,116
AARC 2010 – 2015	0.05%	0.42%	0.08%	0.69%	0.13%	0.29%	0.21%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

Overall, Region V has a very similar age distribution to the rest of the country, but it is less racially and ethnically diverse. The Asian percentage of the total population is notably lower than the national average, the African American and multiracial percentages are somewhat smaller, and the Hispanic percentage is considerably lower. The white population as a percentage of all population is approximately seven percentage points higher than the national average. The white population has seen the greatest decline in population share, and the percentage of Hispanics has grown substantially.

Table 3-104 shows changes in age, racial, and ethnic composition for Region V.

Table 3-104: Age, Racial, and Ethnic Composition of FEMA Region V, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	25.9%	24.0%	23.0%	23.1%	-2.9%
Over 65	12.5%	13.3%	14.8%	14.5%	2.2%
Racial Composition					
White	82.3%	80.1%	80.0%	73.3%	-2.3%
Black or African American	11.1%	11.4%	11.3%	12.6%	0.2%
American Indian or Native Alaskan	0.5%	0.5%	0.4%	0.8%	<0.1%
Asian	2.0%	2.8%	3.3%	5.2%	1.2%
Native Hawaiian or Pacific Islander	<0.1%	<0.1%	<0.1%	0.2%	<0.1%
Other race	2.4%	3.0%	2.5%	4.8%	0.2%
Two or more races	1.6%	2.2%	2.4%	3.0%	0.8%
Ethnic Composition					
Hispanic or Latino	5.2%	7.3%	7.9%	18.2%	2.6%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Although age distribution is relatively similar among States in Region V, there are substantial differences in racial composition within the region. States that are home to the largest cities in the region, such as Illinois, Michigan, and Ohio, show higher percentages of most racial and ethnic minorities than the other States, as shown in Table 3-105. Illinois has the most diverse population.

Table 3-105: Age, Racial, and Ethnic Composition of FEMA Region V by State, 2014

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin	Total for Region V
2014							
Age							
Under 18	23.2%	24.0%	22.4%	23.5%	22.7%	22.6%	23.0%
Over 65	13.9%	14.3%	15.4%	14.3%	15.5%	15.2%	14.8%
Racial Composition							
White	72.1%	84.1%	78.9%	84.4%	82.1%	86.3%	80.0%
Black or African American	14.3%	9.3%	13.9%	5.7%	12.2%	6.3%	11.3%
American Indian or Native Alaskan	0.2%	0.2%	0.6%	1.0%	0.2%	0.9%	0.4%
Asian	5.2%	2.0%	2.8%	4.6%	1.9%	2.6%	3.3%
Native Hawaiian or Pacific Islander	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Other race	5.9%	2.2%	1.2%	1.6%	0.9%	1.8%	2.5%
Two or more races	2.3%	2.2%	2.6%	2.6%	2.6%	2.1%	2.4%
Ethnic Composition							
Hispanic or Latino	16.7%	6.4%	4.8%	5.1%	3.4%	6.4%	7.9%

Source: (USCB, 2014)

3.12.13.5.2 Economic Characteristics

Per capita income in Region V is lower than the national average. This is potentially attributable to significant losses in higher wage manufacturing jobs in the region over the past 20 years. In 2014, the levels of unemployment and individuals under the poverty line were both similar to the national average. Table 3-106 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-106: Economic Indicators in FEMA Region V, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$30,360	$38,240	$43,873	$46,049	-$2,177
Annual Average Unemployment	3.8%	10.2%	6.2%	6.2%	0.0%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	10.0%	14.7%	14.7%	15.8%	-1.1%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-107 provides figures on employment percentages by industry sector. In 2014, Region V had a considerably higher percentage (two or more percentage points difference) of persons working in "manufacturing" than did the nation (3.6 percentage points greater). It had a somewhat lower percentage of workers in "government and government enterprises" than the nation. In all other sectors, Region V had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-107: Employment by Industry Sector for FEMA Region V, 2000–2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000–2014
Total Jobs, all industries	30,126,947	28,988,325	30,627,631	185,798,800	1.7%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	1.8%	1.6%	1.5%	1.4%	0.1%
Forestry, fishing, and related activities	0.2%	0.3%	0.3%	0.5%	-0.2%
Mining, quarrying, and oil and gas extraction	0.2%	0.4%	0.4%	0.9%	-0.5%
Utilities	0.4%	0.4%	0.3%	0.3%	<0.1%
Construction	5.3%	4.5%	4.6%	5.2%	-0.5%
Manufacturing	15.0%	10.1%	10.6%	7.0%	3.6%
Wholesale trade	4.0%	3.7%	3.8%	3.5%	0.3%
Retail trade	11.4%	10.3%	10.1%	10.1%	<0.1%
Transportation and warehousing	3.3%	3.4%	3.6%	3.4%	0.3%
Information	1.9%	1.5%	1.4%	1.8%	-0.3%
Finance and insurance	4.7%	5.3%	5.2%	5.3%	-0.1%
Real estate and rental and leasing	2.8%	3.5%	3.4%	4.4%	-1.0%

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000–2014
Professional, scientific, and technical services	5.5%	5.9%	6.1%	6.9%	-0.8%
Management of companies and enterprises	1.2%	1.4%	1.6%	1.3%	0.3%
Administrative and support and waste management and remediation services	5.6%	6.0%	6.3%	6.3%	0.0%
Educational services	1.5%	2.3%	2.3%	2.4%	0.0%
Health care and social assistance	9.6%	12.2%	12.0%	11.2%	0.8%
Arts, entertainment, and recreation	1.8%	2.0%	2.0%	2.2%	-0.2%
Accommodation and food services	6.2%	6.7%	6.9%	7.3%	-0.4%
Other services (except public administration)	5.2%	5.7%	5.8%	5.9%	-0.1%
Government and government enterprises	12.2%	12.8%	11.7%	12.9%	-1.3%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.5.3 Housing Characteristics

Table 3-108 shows key housing indicators for Region V. The total number of housing units grew modestly from 2000 to 2014, compared to the national increase of 15.5 percent. Median home value increased slightly from 2000 to 2014—much less on a percentage basis than the increase nationally—and remained well below the national average. Housing occupancy rates and owner-occupancy rates were similar for Region V and the nation.

Table 3-108: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region V, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	20,822,354	22,723,556	22,858,111	135,534,245	9.8%
Median Home Value*	$117,956	$129,801	$140,102	$228,549	18.8%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	91.9%	88.8%	88.1%	87.4%	-3.8%
Percentage of Owner-Occupied Housing Units	70.3%	69.3%	67.5%	63.2%	-2.8%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.5.4 Environmental Justice

When viewed at the county level, there are four counties in Region V with a minority population of 50 percent or greater: Wayne County, MI; Cook County, IL; Menominee County, WI; and Mahnomen

County, MN. There are larger portions of Region V where 20 percent or more of the population is living below the poverty level, particularly in central Michigan, southern parts of Ohio, parts of Indiana and Illinois, and northern Wisconsin and Minnesota. These data indicate potential for EJ communities throughout the region. (EPA, 2013a)

3.12.13.5.5 Special Flood Hazard Areas

Table 3-109 shows that none of Region V is in coastal SFHAs. It also shows that the population and housing units of Region V are disproportionately outside of riverine SFHAs, relative to the area within riverine SFHAs. Specifically, while 8.3 percent of the region is located within a riverine SFHA, only 3.8 percent of its population and 4.0 percent of its housing units are located there.

Table 3-109: Area, Population, and Housing Units within SFHAs in FEMA Region V, 2010

	Within SFHA			Region V
	Coastal	Riverine	Total	Total
Area (Square Miles)	0	27,899	27,899	334,511
Percent of Region's Total Area	0.0%	8.3%	8.3%	100.0%
Population	0	1,944,393	1,944,393	51,725,496
Percent of Region's Total Population	0.0%	3.8%	3.8%	100.0%
Housing Units	0	911,924	911,924	22,723,561
Percent of Region's Total Housing Units	0.0%	4.0%	4.0%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.5.6 Flood Insurance Policies and Premiums

Table 3-110 provides figures on flood insurance policies and premiums in Region V compared to the nation. The average flood insurance coverage within Region V is well below the national average, ranging from $176,523 in Ohio to $224,724 in Minnesota. However, average premiums per year are higher than the national average.

Table 3-110: Flood Insurance Policies and Premiums in FEMA Region V, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Illinois	45,571	$8,580,356,600	$188,285	$43,478,155	$954
Indiana	26,537	$4,977,814,600	$187,580	$24,411,111	$920
Michigan	23,462	$4,234,170,300	$180,469	$21,759,902	$927
Minnesota	10,531	$2,366,572,400	$224,724	$8,743,123	$830
Ohio	38,367	$6,772,665,500	$176,523	$34,983,696	$912
Wisconsin	14,042	$2,650,080,000	$188,725	$12,410,472	$884
Total for Region V	158,510	$29,581,659,400	$186,623	$145,786,459	$920
U.S.	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.5.7 Ecosystem Services

While historically a major center of American manufacturing, Region V has also maintained a rural and agricultural character across a large portion of its land base. Cultivated crops, particularly in its southern portion, dominate the region's land cover. In the northern parts of Michigan, Wisconsin, and Minnesota, forests and wetlands occur more frequently (USGS, 2013j). Although cultivated crops do not offer the same environmental benefits as undisturbed natural areas, they still perform useful ecosystem services such as carbon sequestration, groundwater recharge, and absorption of incoming solar radiation, which is typically reflected back as heat energy by impervious surfaces found in the built environment. The forests and wetlands found in the region also provide these same ecosystem services as well, and services such as water purification, stormwater storage, and flood control.

3.12.13.5.8 Natural Disasters

From 1990 through September 2013, Region V had 111 major disaster declarations and 2 emergency declarations involving flooding. Flood events in the region are primarily associated with severe storms and tornadoes. A major flood event occurred in June of 2008, when heavy rainfall followed a high-snow winter and wet spring. Eleven fatalities occurred in six States and estimated damages exceeded $5B. In Region V, Illinois was heavily impacted, with multiple levee failures and overtoppings occurring. Indiana and Wisconsin also had significant damages, with flooding of multiple communities (National Weather Service, 2009b). Hurricane Sandy of October 2012, described under Region II, also impacted several counties in Ohio with flooding. Other recent events include major disaster declarations in Minnesota in July 2013, Michigan in June 2013, and Illinois in May 2013 for severe storms and flooding (FEMA, 2013g).

3.12.13.5.9 Public Health and Safety Services

There are a large number of public health and safety services available throughout the region. The Chicago Police Department is the 2nd largest State/local law enforcement agency in the country, with more than 13,000 full-time sworn personnel (Bureau of Justice Statistics, 2011). Wisconsin has the highest percentage (93.1 percent) of volunteer or mostly volunteer fire departments in the region; Illinois has the highest percentage (18.5 percent) of career or mostly career fire departments (FEMA, 2013i). Table 3-111 shows the distribution of public health and safety services throughout the region.

Table 3-111: Public Health and Safety Services, Region V

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin	Total for Region V
State & Local Law Enforcement Agencies (2008)	877	482	571	448	831	529	**3,738**
Fire Departments (2012)	1,081	761	944	714	1,143	764	**5,407**
Hospitals (2011)	188	125	153	132	183	125	**906**

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.6 FEMA Region VI

3.12.13.6.1 Population and Demographic Characteristics

Region VI, encompassing the south-central United States, experienced much stronger population growth than the country as a whole from 2000 to 2015, but particularly from 2000 to 2010 when the population of the region grew by 15 percent and more than 5 million people. This is reflective of the Sun Belt migration trend discussed earlier. Texas has seen most of the growth in the region. Table 3-112 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Table 3-112: Total Population of FEMA Region VI by State, 2000 – 2015

	Arkansas	Louisiana	New Mexico	Oklahoma	Texas	Total for Region VI
Total Population 2000	2,673,400	4,468,976	1,819,046	3,450,654	20,851,820	33,263,896
Total Population 2010	2,915,918	4,533,372	2,059,179	3,751,351	25,145,561	38,405,381
Change 2000 – 2010	242,518	64,396	240,133	300,697	4,293,741	5,141,485
AARC 2000 – 2010	0.87%	0.14%	1.25%	0.84%	1.89%	1.45%
Total Population 2015	2,978,204	4,670,724	2,085,109	3,911,338	27,469,114	41,114,489
Change 2010 – 2015	62,286	137,352	25,930	159,987	2,323,553	2,709,108
AARC 2010 – 2015	0.42%	0.60%	0.25%	0.84%	1.78%	1.37%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The percentage of the population under the age of 18 in Region VI is slightly higher than the national average, and the percentage above the age of 65 is slightly lower than the national average. The white population as a percentage of the total population increased from 2000 to 2014, which is different from the trend in most regions and the nation as a whole. The percentage of Hispanics grew considerably.

Table 3-113 shows changes in age, racial, and ethnic composition for Region VI.

Table 3-113: Age, Racial, and Ethnic Composition of FEMA Region VI, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	27.6%	26.4%	25.6%	23.1%	-2.0%
Over 65	10.9%	11.3%	12.5%	14.5%	1.6%
Racial Composition					
White	71.1%	70.0%	73.7%	73.3%	2.6%
Black or African American	13.7%	13.5%	13.7%	12.6%	-0.1%
American Indian or Native Alaskan	1.8%	1.9%	1.6%	0.8%	-0.2%
Asian	2.1%	3.0%	3.4%	5.2%	1.3%
Native Hawaiian or Pacific Islander	0.1%	0.1%	0.1%	0.2%	0.0%
Other race	8.7%	8.5%	4.7%	4.8%	-4.0%
Two or more races	2.5%	2.9%	2.9%	3.0%	0.4%
Ethnic Composition					
Hispanic or Latino	23.5%	29.0%	30.1%	18.2%	6.6%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Although age distribution is relatively similar among States in Region VI, there are substantial differences in racial composition within the region, as shown in Table 3-114. Louisiana has a much higher percentage of Black or African Americans than the other States or the nation. New Mexico has much higher percentages of American Indian or Native Alaskan and "other race" populations. Ethnic composition differs, with much higher Hispanic percentages in New Mexico and Texas.

Table 3-114: Age, Racial, and Ethnic Composition of FEMA Region VI by State, 2014

	Arkansas	Louisiana	New Mexico	Oklahoma	Texas	Total for Region VI
2014						
Age						
Under 18	23.8%	24.0%	24.0%	24.6%	26.4%	25.6%
Over 65	15.7%	13.6%	15.3%	14.5%	11.5%	12.5%
Racial Composition						
White	78.3%	62.8%	73.1%	72.9%	75.2%	73.7%
Black or African American	15.8%	32.3%	2.0%	7.4%	12.0%	13.7%
American Indian or Native Alaskan	0.6%	0.6%	9.5%	7.5%	0.5%	1.6%
Asian	1.2%	1.7%	1.5%	2.0%	4.3%	3.4%
Native Hawaiian or Pacific Islander	0.2%	0.1%	<0.1%	0.1%	0.1%	0.1%
Other race	1.7%	0.9%	10.8%	2.4%	5.5%	4.7%
Two or more races	2.2%	1.7%	3.0%	7.7%	2.5%	2.9%
Ethnic Composition						
Hispanic or Latino	6.9%	4.8%	47.7%	9.8%	38.6%	30.1%

Source: (USCB, 2014)

3.12.13.6.2 Economic Characteristics

Per capita income in Region VI in 2014 was below the national average. The percentage of unemployment in the region was lower than the nation's percentage in 2014. The percentage of individuals in poverty was above the national rate. Table 3-115 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-115: Economic Indicators in FEMA Region VI, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$26,638	$37,171	$44,038	$46,049	-$2,011
Annual Average Unemployment	4.3%	8.0%	5.3%	6.2%	-0.9%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	16.1%	18.1%	17.8%	15.8%	1.9%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-116 provides figures on employment percentages by industry sector. In 2014, Region VI had a considerably higher percentage (two or more percentage points difference) of persons working in "mining, quarrying, and oil and gas extraction" than did the nation. It had a somewhat higher percentage of workers in "construction," and a somewhat lower percentage of workers in "health care and social assistance services" than the nation. In all other industries, Region VI had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-116: Employment by Industry Sector for FEMA Region VI, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	18,965,113	21,560,370	23,612,680	185,798,800	24.5%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	2.7%	2.2%	2.0%	1.4%	0.5%
Forestry, fishing, and related activities	0.6%	0.5%	0.5%	0.5%	<0.1%
Mining, quarrying, and oil and gas extraction	1.8%	2.9%	3.7%	0.9%	2.8%
Utilities	0.4%	0.4%	0.4%	0.3%	0.1%
Construction	6.6%	6.3%	6.4%	5.2%	1.2%
Manufacturing	9.2%	6.2%	6.2%	7.0%	-0.8%
Wholesale trade	3.9%	3.5%	3.6%	3.5%	0.2%
Retail trade	11.2%	10.0%	9.9%	10.1%	-0.2%
Transportation and warehousing	3.7%	3.4%	3.6%	3.4%	0.3%
Information	2.2%	1.5%	1.4%	1.8%	-0.3%
Finance and insurance	4.3%	5.1%	5.2%	5.3%	-0.1%

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Real estate and rental and leasing	3.2%	4.1%	4.1%	4.4%	-0.2%
Professional, scientific, and technical services	5.3%	6.0%	6.1%	6.9%	-0.8%
Management of companies and enterprises	0.6%	0.9%	1.0%	1.3%	-0.3%
Administrative and support and waste management and remediation services	5.9%	6.2%	6.4%	6.3%	0.1%
Educational services	1.2%	1.5%	1.6%	2.4%	-0.8%
Health care and social assistance	8.3%	10.0%	9.9%	11.2%	-1.3%
Arts, entertainment, and recreation	1.5%	1.6%	1.6%	2.2%	-0.6%
Accommodation and food services	6.4%	6.9%	7.2%	7.3%	<0.1%
Other services (except public administration)	5.6%	5.6%	5.8%	5.9%	<0.1%
Government and government enterprises	15.1%	15.1%	13.4%	12.9%	0.5%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.6.3 Housing Characteristics

Table 3-117 shows key housing indicators for Region VI. The total number of housing units grew considerably from 2000 to 2014, more than the national increase of 15.5 percent, and consistent with overall increases in population growth in the region for that period. Median home value grew considerably from 2000 to 2014; however, home values remain well below the national average, indicating housing in the region is relatively affordable. Rates of owner occupancy and home ownership are consistent with the national average.

Table 3-117: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region VI, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	13,472,778	15,824,482	16,391,344	135,534,245	21.7%
Median Home Value*	$92,895	$135,600	$146,855	$228,549	58.1%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	89.9%	88.8%	87.5%	87.4%	-2.4%
Percentage of Owner-Occupied Housing Units	65.7%	65.1%	62.6%	63.2%	-3.1%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.6.4 Environmental Justice

There are large areas of Region VI that may have the potential for EJ communities. There are many counties throughout the region with both a minority population greater than 50 percent and a poverty level greater than 20 percent. Minority populations are found along the eastern border of Arkansas and Louisiana, in three counties in Oklahoma, along the entire southern and western borders of Texas, and in virtually all of New Mexico, except for a band of counties crossing the center and northeast portions of the State. Every State in Region VI has counties with 20 percent or more of residents below the poverty level, with fewer occurrences in central Arkansas, central Texas, and western Oklahoma. (EPA, 2013a)

3.12.13.6.5 Special Flood Hazard Areas

The population and housing units of Region VI are within coastal SFHAs roughly in proportion to the area in coastal SFHAs, and both population and housing units in the region are disproportionately outside of riverine SFHAs, relative to the area within riverine SFHAs, as shown in Table 3-118. As shown below, 3.4 percent of the region's area, 2.5 percent of its housing units, and 2.9 percent of its population are located within a coastal SFHA. While 10.4 percent of the region is within a riverine SFHA, 7.8 percent of its population and 7.9 percent of its housing units are within a riverine SFHA.

Table 3-118: Area, Population, and Housing Units within SFHAs in FEMA Region VI, 2010

	Within SFHA			Region VI
	Coastal	Riverine	Total	Total
Area (Square Miles)	19,224	58,587	77,811	561,164
Percent of Region's Total Area	3.4%	10.4%	13.9%	100.0%
Population	953,334	3,009,034	3,962,368	38,725,228
Percent of Region's Total Population	2.5%	7.8%	10.2%	100.0%
Housing Units	459,159	1,266,909	1,726,068	15,963,649
Percent of Region's Total Housing Units	2.9%	7.9%	10.8%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.6.6 Flood Insurance Policies and Premiums

Table 3-119 provides figures on flood insurance policies and premiums in Region VI compared to the nation. The average flood insurance coverage per year varies significantly within Region VI, ranging from $165,666 (Arkansas) to $265,230 (Texas). The average premium per year within Region VI is essentially equivalent to the national average of $694.

Table 3-119: Flood Insurance Policies and Premiums in FEMA Region VI, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Arkansas	18,693	$3,096,796,100	$165,666	$13,784,368	$737
Louisiana	452,823	$111,132,733,400	$245,422	$350,912,990	$775
New Mexico	14,382	$2,858,521,700	$198,757	$11,062,534	$769
Oklahoma	15,793	$3,099,561,900	$196,262	$11,994,241	$759
Texas	587,692	$155,873,406,800	$265,230	$354,000,997	$602
Total for Region VI	1,089,383	$276,061,019,900	$253,410	$741,755,130	$681
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.6.7 Ecosystem Services

Diverse land cover characterizes Region VI, ranging from forestlands mixed with croplands in the east to desert scrub and shrublands in the central and western part of the region. The southern portion of the region includes the Gulf coast regions of Louisiana and Texas, characterized by wetlands and barrier islands (USGS, 2013j). These systems each provide a wide range of services, including erosion control, groundwater recharge, storm surge protection, flood protection, carbon sequestration, nutrient cycling, and air and water purification.

3.12.13.6.8 Natural Disasters

From 1990 through September 2013, Region VI had 77 major disaster declarations and 3 emergency declarations involving flooding. Flood events have typically been associated with severe storms, tornadoes, tropical storms, and hurricanes, with recent events including major disaster declarations due to tornadoes in Arkansas in June 2013 and in Oklahoma in June 2012 (FEMA, 2013g). Region VI is in the southern portion of a broader geographic area with a disproportionately high number of tornado occurrences, sometimes referred to as "tornado alley." Tornadoes in this area are most common in early spring and early fall; Texas averages 155 tornadoes per year. This area is ideally situated for the formation of supercell thunderstorms, which produce violent tornadoes (NCDC, 2013).

In 2005, Hurricane Katrina—a Category 5 hurricane—caused estimated property damages of $108B in Texas, Louisiana, and portions of FEMA Region IV (Knabb, Tropical Cyclone Report Hurricane Katrina, 2006). In 2008, Texas was hit by a span of storms over a 60-day period: Hurricanes Dolly, Gustav, and Ike and Tropical Storm Eduardo. Of these, Hurricane Ike was the most costly and destructive storm ever to hit Texas. Hurricane Ike made landfall as a Category 2 storm in Galveston, TX with sustained winds of 110 mph, a 22-foot storm surge, and extensive coastal flooding along the Texas Gulf coast. Estimates from cities and counties in the areas impacted by Hurricane Ike reported more than $3B in total housing damage (FEMA, 2008).

3.12.13.6.9 Public Health and Safety Services

Public health and safety services are available throughout Region VI, although their availability may be scarcer in the more rural parts of the region. The largest law enforcement agency in the region and 8th largest in the country is the Houston Police Department with more than 5,000 sworn full-time personnel (Bureau of Justice Statistics, 2011). Arkansas has the highest percentage (93.6 percent) of volunteer or mostly volunteer fire departments in the region; Texas has the highest percentage of career or mostly career fire departments with 14.4 percent (FEMA, 2013i). Table 3-120 shows the distribution of public health and safety services throughout Region VI.

Table 3-120: Public Health and Safety Services, Region VI

	Arkansas	Louisiana	New Mexico	Oklahoma	Texas	Total for Region VI
State & Local Law Enforcement Agencies (2008)	367	348	146	481	1,913	**3,255**
Fire Departments (2012)	672	378	242	709	1,435	**3,436**
Hospitals (2011)	84	127	36	115	420	**782**

Source: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.7 FEMA Region VII

3.12.13.7.1 Population and Demographic Characteristics

Population growth in Region VII was slower than the national average from 2000 through 2015. Missouri is the most populous State in the region by a wide margin, and has seen the greatest numeric increase in population. It is home to two major cities, St. Louis and Kansas City, which are central to the economy of the region. Table 3-121 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Table 3-121: Total Population of FEMA Region VII by State, 2000 – 2015

	Iowa	Kansas	Missouri	Nebraska	Total for Region VII
Total Population 2000	2,926,324	2,688,418	5,595,211	1,711,263	12,921,216
Total Population 2010	3,046,355	2,853,118	5,988,927	1,826,341	13,714,741
Change 2000 – 2010	120,031	164,700	393,716	115,078	793,525
AARC 2000 – 2010	0.40%	0.60%	0.68%	0.65%	0.60%
Total Population 2015	3,123,899	2,911,641	6,083,672	1,896,190	14,015,402
Change 2010 – 2015	77,544	58,523	94,745	69,849	300,661
AARC 2010 – 2015	0.50%	0.41%	0.31%	0.75%	0.43%

AARC: Average Annual Rate of Change

Source: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The racial and ethnic compositions of Region VII have changed somewhat since 2000, with increases in several non-white races and a considerable increase in the Hispanic population as well. Despite these changes, which are consistent with national demographic trends, the region remains one of the less diverse areas of the country. All minority group percentages of the region's total population in 2014 were well below the national percentages. The age distribution is not substantially different from the United States as a whole. Table 3-122 shows changes in age, racial, and ethnic composition for Region VII.

Table 3-122: Age, Racial, and Ethnic Composition of FEMA Region VII, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	25.7%	24.4%	23.7%	23.1%	-2.0%
Over 65	13.8%	14.0%	15.1%	14.5%	1.3%
Racial Composition					
White	87.8%	85.3%	85.7%	73.3%	-2.1%
Black or African American	7.1%	7.5%	7.7%	12.6%	0.6%
American Indian or Native Alaskan	0.6%	0.6%	0.6%	0.8%	<0.1%
Asian	1.3%	1.8%	2.1%	5.2%	0.8%
Native Hawaiian or Pacific Islander	0.0%	0.1%	0.1%	0.2%	<0.1%
Other race	1.7%	2.4%	1.4%	4.8%	-0.3%
Two or more races	1.5%	2.2%	2.5%	3.0%	1.0%
Ethnic Composition					
Hispanic or Latino	3.7%	6.1%	6.6%	18.2%	2.9%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Although age distribution is relatively similar among States in Region VII, there are substantial differences in racial composition within the region, as show in in

Table 3-123. Missouri has the highest percentage of Black or African American population. Kansas and Nebraska have the highest percentages of Hispanic population. Iowa has the highest percentage of White population and in most cases the lowest percentages of other races.

Table 3-123: Age, Racial, and Ethnic Composition of FEMA Region VII by State, 2014

	Iowa	Kansas	Missouri	Nebraska	Total for Region VII
2014					
Age					
Under 18	23.4%	24.9%	23.0%	24.9%	23.7%
Over 65	15.8%	14.4%	15.4%	14.4%	15.1%
2014					
Age					
Racial Composition					
White	91.3%	84.9%	82.3%	88.3%	85.7%
Black or African American	3.1%	5.9%	11.7%	4.7%	7.7%
American Indian or Native Alaskan	0.3%	0.8%	0.4%	1.0%	0.6%
Asian	2.2%	2.6%	1.8%	2.1%	2.1%
Native Hawaiian or Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.1%
Other race	1.0%	2.2%	1.2%	1.6%	1.4%
Two or more races	1.9%	3.4%	2.5%	2.3%	2.5%
Ethnic Composition					
Hispanic or Latino	5.5%	11.3%	3.8%	10.1%	6.6%

Source: (USCB, 2014)

3.12.13.7.2 Economic Characteristics

Per capita income in Region VII has largely tracked with the national figures. In 2014, per capita income was slightly lower than the national average. The unemployment rate and percentage of individuals living below the poverty level were better than (below) the national rates in 2014. Table 3-124 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-124: Economic Indicators in FEMA Region VII, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$28,192	$38,085	$43,848	$46,049	-$2,202
Annual Average Unemployment	3.3%	7.5%	5.0%	6.2%	-1.2%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	10.5%	14.0%	13.9%	15.8%	-1.9%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-125 provides figures on employment percentages by industry sector. In 2014, Region VII had a considerably higher percentage (two or more percentage points difference) of persons working in "farm employment" than the nation. It had a somewhat higher percentage of workers in "manufacturing." Iowa had somewhat lower percentage of workers in "real estate and rental and leasing" and "professional, scientific, and technical services" than the nation. In all other industries, Region VII had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-125: Employment by Industry Sector for FEMA Region VII, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	8,318,851	8,434,577	8,806,729	185,798,800	5.9%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	4.5%	3.7%	3.4%	1.4%	2.0%
Forestry, fishing, and related activities	0.4%	0.6%	0.6%	0.5%	0.1%
Mining, quarrying, and oil and gas extraction	0.4%	0.6%	0.8%	0.9%	-0.1%
Utilities	0.4%	0.4%	0.3%	0.3%	<0.1%
Construction	5.5%	5.1%	5.2%	5.2%	0.1%
Manufacturing	11.4%	8.6%	8.7%	7.0%	1.7%
Wholesale trade	3.8%	3.6%	3.6%	3.5%	0.2%
Retail trade	11.6%	10.5%	10.4%	10.1%	0.4%
Transportation and warehousing	3.7%	3.5%	3.7%	3.4%	0.3%
Information	2.5%	1.8%	1.6%	1.8%	-0.2%
Finance and insurance	4.8%	5.7%	5.7%	5.3%	0.4%
Real estate and rental and leasing	2.6%	3.3%	3.3%	4.4%	-1.1%
Professional, scientific, and technical services	4.3%	4.8%	5.0%	6.9%	-1.9%
Management of companies and enterprises	1.3%	1.3%	1.5%	1.3%	0.2%
Administrative and support and waste management and remediation services	4.8%	5.1%	5.3%	6.3%	-1.0%
Educational services	1.6%	2.0%	2.1%	2.4%	-0.3%
Health care and social assistance	9.3%	10.9%	11.1%	11.2%	-0.1%
Arts, entertainment, and recreation	1.7%	1.9%	1.9%	2.2%	-0.4%
Accommodation and food services	6.1%	6.5%	6.6%	7.3%	-0.7%
Other services (except public administration)	5.3%	5.4%	5.5%	5.9%	-0.4%
Government and government enterprises	14.0%	14.7%	13.7%	12.9%	0.8%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.7.3 Housing Characteristics

Table 3-126 shows key housing indicators for Region VII. The total number of housing units grew moderately from 2000 to 2014, compared to the national increase of 15.5 percent. Median home value grew moderately from 2000 to 2014 as well. However, home values in the region in 2014 were substantially lower than the national average, indicating relative affordability. Housing occupancy rates and owner-occupancy rates were similar for Region VII and the nation.

Table 3-126: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region VII 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	5,528,396	6,079,154	6,161,655	135,534,245	11.5%
Median Home Value*	$93,787	$117,366	$126,565	$228,549	35.0%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	91.3%	89.3%	88.4%	87.4%	-2.9%
Percentage of Owner-Occupied Housing Units	70.2%	69.1%	67.6%	63.2%	-2.5%

* Median Home Value represents a simple average of each State's value

Source: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.7.4 Environmental Justice

County level data indicate that only seven counties within Region VII have minority populations greater than 50 percent, although there are many counties with a poverty rate in excess of 20 percent, particularly in southern Missouri. These data indicate that there is potential for EJ communities in the region. (EPA, 2013a)

3.12.13.7.5 Special Flood Hazard Areas

Table 3-127 shows that none of Region VII is in coastal SFHAs. It also shows that the population and housing units of Region VII are disproportionately outside of riverine SFHAs, relative to the area within riverine SFHAs. Specifically, while 9.5 percent of the region is located within a riverine SFHA, only 4.8 percent of its population and 5.0 percent of its housing units are located there.

Table 3-127: Area, Population, and Housing Units within SFHAs in FEMA Region VII, 2010

	Within SFHA			Region VII
	Coastal	Riverine	Total	Total
Area (Square Miles)	0	27,124	27,124	285,607
Percent of Region's Total Area	0.0%	9.5%	9.5%	100.0%
Population	0	655,571	655,571	13,714,740
Percent of Region's Total Population	0.0%	4.8%	4.8%	100.0%
Housing Units	0	305,761	305,761	6,079,154
Percent of Region's Total Housing Units	0.0%	5.0%	5.0%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.7.6 Flood Insurance Policies and Premiums

Table 3-128 provides figures on flood insurance policies and premiums in Region VII compared to the nation. The average flood insurance coverage is similar across the States within Region VII and is considerably lower than the rest of the country. The regional average premium per year within Region ranges from $807 in Kansas to $945 in Missouri, and is higher than the national average ($694).

Table 3-128: Flood Insurance Policies and Premiums in FEMA Region VII, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Iowa	14,368	$2,749,268,500	$191,347	$13,102,301	$912
Kansas	11,211	$1,988,300,500	$177,353	$9,047,943	$807
Missouri	22,935	$4,176,442,900	$182,099	$21,662,217	$945
Nebraska	11,005	$2,003,499,900	$182,054	$9,885,513	$898
Total for Region VII	59,519	$10,917,511,800	$183,429	$53,697,974	$902
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.7.7 Ecosystem Services

Land cover varies significantly throughout Region VII. Missouri has substantial agricultural lands, predominantly pasture and hay, with forests and crop agriculture found in the southeastern part of the State. Iowa is heavily dominated by crop agriculture, whereas Nebraska and Kansas are a mix of crop agriculture, grasslands, and limited wetlands. As mentioned previously, although crops do not provide the same caliber of benefits as undisturbed natural systems and frequently require the use of pesticides and fertilizers, they do still provide ecosystem services. The natural systems found in Region VII perform such functions as erosion control, carbon sequestration, flood protection, and groundwater recharge.

3.12.13.7.8 Natural Disasters

From 1990 through September 2013, Region VII had 93 major disaster declarations and 3 emergency declarations involving flooding. Flood events are typically associated with severe storms, tornadoes, and straight-line winds. States in Region VII are part of "tornado alley," with Kansas averaging 96 tornadoes per year (NCDC, 2013). Recent events include major disaster declarations in Missouri in September 2013 due to severe storms, winds, and flooding; in Iowa in July 2013 due to severe storms, tornadoes, and flooding; and in June 2013 in Missouri due to severe storms, winds, tornadoes, and flooding (FEMA, 2013g).

A major flood event occurred in June of 2008, when heavy rainfall followed a high-snow winter and wet spring. Eleven fatalities occurred in six Midwestern States and estimated damages exceeded $5B. In Region VII, Iowa was particularly hard-hit. The city of Cedar Rapids was extensively flooded, with nearly 5,400 homes and 700 businesses damaged or destroyed. In Iowa City, damage to the University of Iowa alone was estimated at $740M. Multiple levee failures and overtoppings occurred in the State, including overtopping of an Iowa River levee that flooded 19,000 acres and inundated the entire community of Oakville (National Weather Service, 2009b). Oakville has been slow to recover. Its population was 439 before the flood but only 160 in 2010 (Keen, 2010). Missouri also experienced a number of significant levee failures and overtoppings (National Weather Service, 2009b).

3.12.13.7.9 Public Services

Public health and safety services are available throughout the region. The St. Louis Metropolitan Police Department is the largest law enforcement agency in the region with more than 1,300 full-time sworn personnel (Bureau of Justice Statistics, 2011). At 96.5 percent, Nebraska has the largest percentage of volunteer fire departments in the region, closely followed by Iowa (96.2 percent); Missouri has the largest percentage of career or mostly career fire departments (14.6 percent) (FEMA, 2013i). Table 3-129 shows the distribution of public health and safety services throughout the region.

Table 3-129: Public Health and Safety Services, Region VII

	Iowa	Kansas	Missouri	Nebraska	Total for Region VII
State & Local Law Enforcement Agencies (2008)	392	371	576	225	**1,564**
Fire Departments (2012)	731	467	731	372	**2,301**
Hospitals (2011)	118	132	120	86	**456**

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.8 FEMA Region VIII

3.12.13.8.1 Population and Demographic Characteristics

The population growth rate in Region VIII has been very strong from 2000 through 2015, almost twice the national average. This may be due, in part, to the boom in the area in oil and gas extraction operations, particularly natural gas, which has resulted in domestic migration into the region. It is also partly due to the expanding economy and population of the Denver, Colorado metropolitan area. Colorado is the most populous State in the region, accounting for almost half of the total population.

Table 3-130 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Table 3-130: Total Population of FEMA Region VIII by State, 2000 – 2015

	Colorado	Montana	North Dakota	South Dakota	Utah	Wyoming	Total for Region VIII
Total Population 2000	4,301,261	902,195	642,200	754,844	2,233,169	493,782	9,327,451
Total Population 2010	5,029,196	989,415	672,591	814,180	2,763,885	563,626	10,832,893
Change 2000 – 2010	727,935	87,220	30,391	59,336	530,716	69,844	1,505,442
AARC 2000 – 2010	1.58%	0.93%	0.46%	0.76%	2.16%	1.33%	1.51%
Total Population 2015	5,456,574	1,032,949	756,927	858,469	2,995,919	586,107	11,686,945
Change 2010 – 2015	427,378	43,534	84,336	44,289	232,034	22,481	854,052
AARC 2010 – 2015	1.64%	0.86%	2.39%	1.07%	1.63%	0.79%	1.53%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

Region VIII is less racially and ethnically diverse than the nation as a whole. Whites, as a percentage of the total population, have remained well above the national average, with lower percentages of African Americans, Asians, and Hispanics. However, the Hispanic share of the total population in Colorado is higher than the national share. The region is home to several large American Indian reservations, and the American Indian share of the total population is almost three times the national average; it is highest in Montana, North Dakota, and South Dakota. The portion of the population that is under the age of 18 is higher than the national average, and the percentage over the age of 65 is less than the national average. Table 3-131 and Table 3-132 show the distribution of age, race, and ethnicity within the region and by State.

Table 3-131: Age, Racial, and Ethnic Composition of FEMA Region VIII, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	27.3%	25.9%	25.2%	23.1%	-2.1%
Over 65	10.6%	11.4%	12.7%	14.5%	2.1%
Racial Composition					
White	86.7%	84.6%	86.2%	73.3%	-0.5%
Black or African American	2.1%	2.4%	2.5%	12.6%	0.4%
American Indian or Native Alaskan	2.5%	2.5%	2.5%	0.8%	0.0%
Asian	1.6%	2.0%	2.2%	5.2%	0.7%
Native Hawaiian or Pacific Islander	0.2%	0.3%	0.3%	0.2%	0.1%
Other race	4.6%	5.2%	3.3%	4.8%	-1.3%
Two or more races	2.3%	2.9%	2.9%	3.0%	0.7%
Ethnic Composition					
Hispanic or Latino	10.8%	14.0%	14.6%	18.2%	3.8%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

Table 3-132: Age, Racial, and Ethnic Composition of FEMA Region VIII by State, 2014

	Colorado	Montana	North Dakota	South Dakota	Utah	Wyoming	Total for Region VIII
2014							
Age							
Under 18	23.3%	21.9%	22.7%	24.7%	30.8%	23.6%	25.2%
Over 65	12.7%	16.6%	14.2%	15.2%	10.0%	13.8%	12.7%
Racial Composition							
White	84.4%	89.4%	88.5%	84.9%	87.3%	91.0%	86.2%
Black or African American	4.0%	0.6%	2.0%	1.7%	1.1%	1.1%	2.5%
American Indian or Native Alaskan	1.0%	6.8%	5.4%	8.4%	1.1%	2.6%	2.5%
Asian	2.9%	0.8%	1.2%	1.3%	2.2%	0.9%	2.2%
Native Hawaiian or Pacific Islander	0.1%	<0.1%	<0.1%	0.1%	0.9%	0.1%	0.3%
Other race	4.0%	0.3%	0.6%	0.8%	4.7%	2.0%	3.3%
Two or more races	3.4%	2.1%	2.3%	2.8%	2.7%	2.2%	2.9%
Ethnic Composition							
Hispanic or Latino	21.2%	3.4%	2.8%	3.4%	13.5%	9.8%	14.6%

Source: (USCB, 2014)

3.12.13.8.2 Economic Characteristics

Per capita income in Region VIII is slightly lower than in the nation as a whole. Overall, unemployment and poverty in the region are both lower than the national average. Table 3-133 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014.

Table 3-133: Economic Indicators in FEMA Region VIII, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$29,529	$38,958	$45,673	$46,049	-$376
Annual Average Unemployment	3.2%	7.7%	4.4%	6.2%	-1.8%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	10.4%	13.4%	12.3%	15.8%	-3.5%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-134 provides figures on employment percentages by industry sector. In 2014, Region VIII had a somewhat higher percentage (greater than one but less than two percentage points difference) of persons working in "construction," "mining, quarrying, and oil and gas extraction," and "government and government enterprises" than did the nation. It had a somewhat lower percentage of workers in "manufacturing," "administrative and support and waste management and remediation services," and "health care and social assistance" than the nation. In all other industries, Region VIII had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-134: Employment by Industry Sector for FEMA Region VIII, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	6,125,885	6,804,194	7,469,057	185,798,800	21.9%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	3.0%	2.5%	2.3%	1.4%	0.9%
Forestry, fishing, and related activities	0.5%	0.5%	0.5%	0.5%	0.0%
Mining, quarrying, and oil and gas extraction	1.0%	1.8%	2.3%	0.9%	1.4%
Utilities	0.4%	0.4%	0.3%	0.3%	0.0%
Construction	7.2%	6.0%	6.4%	5.2%	1.2%
Manufacturing	7.1%	5.1%	5.3%	7.0%	-1.7%
Wholesale trade	3.6%	3.2%	3.3%	3.5%	-0.2%
Retail trade	11.4%	10.2%	10.0%	10.1%	0.0%
Transportation and warehousing	3.1%	2.8%	3.1%	3.4%	-0.3%
Information	3.1%	2.2%	2.0%	1.8%	0.2%
Finance and insurance	5.1%	5.9%	5.8%	5.3%	0.5%
Real estate and rental and leasing	3.8%	4.9%	4.8%	4.4%	0.4%
Professional, scientific, and technical services	6.1%	6.9%	7.1%	6.9%	0.2%
Management of companies and enterprises	0.8%	1.0%	1.0%	1.3%	-0.2%
Administrative and support and waste management and remediation services	5.4%	5.1%	5.2%	6.3%	-1.1%
Educational services	1.3%	2.0%	2.1%	2.4%	-0.3%
Health care and social assistance	8.0%	9.4%	9.3%	11.2%	-1.9%
Arts, entertainment, and recreation	2.2%	2.4%	2.4%	2.2%	0.2%
Accommodation and food services	7.2%	7.2%	7.4%	7.3%	0.1%
Other services (except public administration)	5.2%	5.2%	5.2%	5.9%	-0.7%
Government and government enterprises	14.6%	15.2%	14.2%	12.9%	1.2%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.8.3 Housing Characteristics

Table 3-135 shows key housing indicators for Region VIII. The total number of housing units grew considerably from 2000 to 2014, much more than the national increase of 15.5 percent. Median home values were below the national average in 2014, but home prices have grown at a relatively high rate since 2000, and the price gap is narrowing. The occupancy rate and percentage of owner occupancy are largely consistent with the national average.

Table 3-135: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region VIII 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	3,826,003	4,618,236	4,785,474	135,534,245	25.1%
Median Home Value*	$112,875	$174,656	$205,172	$228,549	81.8%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	90.4%	88.6%	88.6%	87.4%	-1.8%
Percentage of Owner-Occupied Housing Units	68.5%	67.2%	65.8%	63.2%	-2.8%

* Median Home Value represents a simple average of each State's value

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.8.4 Environmental Justice

There are 18 counties in Region VIII with minority populations greater than 50 percent, many of which contain American Indian reservations. Many counties throughout the region have a poverty level above 20 percent, particularly in South Dakota and Montana. These data indicate that there are low-income populations and minority populations, and therefore the potential for EJ communities, throughout the region. (EPA, 2013a)

3.12.13.8.5 Special Flood Hazard Areas

Table 3-136 shows that none of Region VIII is in coastal SFHAs. It also shows that the population and housing units of Region VIII are disproportionately within riverine SFHAs relative to the area within riverine SFHAs. Specifically, while 2.1 percent of the region is located within a riverine SFHA, 3.2 percent of its population and 3.5 percent of its housing units are located there.

Table 3-136: Area, Population, and Housing Units within SFHAs in FEMA Region VIII, 2010

	Within SFHA			Region VIII
	Coastal	Riverine	Total	Total
Area (Square Miles)	0	11,938	11,938	581,687
Percent of Region's Total Area	0.0%	2.1%	2.1%	100.0%
Population	0	347,346	347,346	10,837,300
Percent of Region's Total Population	0.0%	3.2%	3.2%	100.0%
Housing Units	0	162,949	162,949	4,620,668
Percent of Region's Total Housing Units	0.0%	3.5%	3.5%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.8.6 Flood Insurance Policies and Premiums

Table 3-137 provides figures on flood insurance policies and premiums in Region VIII compared to the nation. The average flood insurance coverage is roughly similar within most of Region VIII (excepting a lower average in Montana) and consistent with the rest of the country. The regional average premium per year varies substantially within Region VIII, ranging from $629 in North Dakota to $880 in South Dakota; the national average is $694.

Table 3-137: Flood Insurance Policies and Premiums in FEMA Region VIII, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Colorado	23,267	$5,646,665,600	$242,690	$18,284,640	$786
Montana	5,220	$1,038,645,200	$198,974	$3,600,873	$690
North Dakota	12,255	$3,242,892,100	$264,618	$7,711,370	$629
South Dakota	4,814	$1,087,878,000	$225,982	$4,235,901	$880
Utah	3,986	$975,307,500	$244,683	$2,521,598	$633
Wyoming	2,021	$478,790,600	$236,908	$1,690,938	$837
Total for Region VIII	51,563	$12,470,179,000	$241,844	$38,045,320	$738
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.8.7 Ecosystem Services

Region VIII is one of the least developed regions in the country, and home to a wide range of natural habitats, including grasslands and shrublands through large portions of the Dakotas, eastern Montana, Wyoming, Utah, and eastern Colorado. Western Montana, western Colorado, northwest Wyoming, and central Utah are characterized by evergreen and deciduous forests. There is a strong agricultural presence in eastern North and South Dakotas, northern Montana, and eastern Colorado (USGS, 2013j). These systems provide a myriad of services to the region, including nutrient cycling, flood protection, groundwater recharge, air and water purification, erosion control, and carbon sequestration.

3.12.13.8.8 Natural Disasters

From 1990 through September 2013, Region VIII had 54 major disaster declarations and 3 emergency declarations involving flooding. Flood events in the region are typically associated with severe storms, tornadoes, and ground saturation. Recent events include major disaster declarations in South Dakota due to flooding in August and June 2013; in North Dakota due to Flooding in July, May, and April 2013; in Colorado due to flooding, landslides, and mudslides in September 2013; and in Montana due to flooding in July 2013 (FEMA, 2013g). The southeastern portion of Region VIII is included in "tornado alley," with Colorado experiencing an average of 53 tornadoes annually (NCDC, 2013).

A major flood event occurred in mid-2011 in the Missouri River Basin and the Souris River Basin (the Souris River flows from Canada into North Dakota and back into Canada) due to record-setting rains in headwaters areas of Montana, North Dakota, and Canada. Over $2B dollars in damages and five fatalities resulted in the United States in FEMA Regions VII and VIII. Approximately 11,000 people evacuated

Minot, North Dakota (one-quarter of the population) as 4,000 homes were flooded along the Souris River. Many levees along the Missouri River were breached or overtopped (National Weather Service, 2012b).

Numerous other flooding events have occurred in the Great Plains portion of Region VIII. For instance, flooding has occurred periodically in and around Fargo, North Dakota, when the Red River rises due to snowmelt or heavy rains (Weather.com, 2013). The Rocky Mountain portions of Region VIII are also not immune from flooding. Major rain events can swell mountain rivers, sometimes as flash floods, causing damages that are usually localized but can be severe. The September 2013 major disaster declaration in Colorado reflected the effects of unusually heavy and prolonged rains along the Front Range of the Rockies between Denver and Fort Collins. Multiple creeks and rivers draining from the mountains towards the plains rose to historic levels, washing out roads, bridges, and buildings along mountain canyons and the floodplains to the east. Damages were estimated at $2B initially (Coffman, 2013). As of 100 days after the flooding, more than $204M had gone to individuals and households in recovery assistance, flood insurance payments and low-interest disaster loans, and more than $28M had been obligated to begin to repair and rebuild critical infrastructure and restore vital services (FEMA, 2013j).

3.12.13.8.9 Public Health and Safety Services

Public health and safety services are available throughout the region, although they may be more dispersed in rural areas. The largest law enforcement department in the region, and 50th largest in the country, is the Denver Police Department with more than 1,500 full-time sworn personnel. North Dakota has the highest percentage in the region, and 3rd highest in the country, of volunteer or mostly volunteer fire departments at 97.1 percent. Colorado has the highest percentage of career or mostly career fire departments in the region with 19.4 percent (FEMA, 2013i). Table 3-138 shows the distribution of public health and safety services in Region VIII.

Table 3-138: Public Health and Safety Services, Region VIII

	Colorado	Montana	North Dakota	South Dakota	Utah	Wyoming	Total for Region VIII
State & Local Law Enforcement Agencies (2008)	246	119	114	155	136	90	**860**
Fire Departments (2012)	325	263	302	282	187	108	**1,467**
Hospitals (2011)	82	48	41	53	46	24	**294**

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.9 FEMA Region IX

3.12.13.9.1 Population and Demographic Characteristics

The population growth rate in Region IX has been higher than the national average. Similar to Regions IV and VI, this growth may be partially attributable to the Sun Belt migration trend. California is by far the most populous State in the region, and has seen most of the region's growth. Arizona and Nevada have also grown substantially. Table 3-139 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Table 3-139: Total Population of FEMA Region IX by State, 2000 – 2015

	Arizona	California	Hawaii	Nevada	Pacific Islands	Total for Region IX
Total Population 2000	5,130,632	33,871,648	1,211,537	1,998,257	281,317	42,493,391
Total Population 2010	6,392,017	37,253,956	1,360,301	2,700,551	268,760	47,975,585
Change 2000 – 2010	1,261,385	3,382,308	148,764	702,294	-12,557	5,482,194
AARC 2000 – 2010	2.22%	0.96%	1.16%	3.06%	-0.46%	1.22%
Total Population 2015	6,828,065	39,144,818	1,431,603	2,890,845	280,493	50,575,824
Change 2010 – 2015	436,048	1,890,862	71,302	190,294	11,733	2,600,239
AARC 2010 – 2015	1.33%	1.00%	1.03%	1.37%	0.86%	1.06%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

The region is racially and ethnically diverse. The Asian, Native Hawaiian/Pacific Islander, and Hispanic populations have much higher shares of the population than the national averages; individuals identifying as 'other race' represent 11.7 percent of the 2015 population (national average of 4.8 percent). The African American share is considerably lower regionally than nationally. The age profile of the region is not substantially different from the nation as a whole. Table 3-140 shows changes in age, racial, and ethnic composition for Region IX, not including the Pacific Island territories as data on racial and ethnic composition was not available.

Table 3-140: Age, Racial, and Ethnic Composition of FEMA Region IX, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	27.1%	24.9%	23.6%	23.1%	-3.5%
Over 65	11.0%	11.8%	13.4%	14.5%	2.4%
Racial Composition					
White	61.2%	59.2%	63.0%	73.3%	1.8%
Black or African American	6.1%	5.9%	5.7%	12.6%	-0.5%
American Indian or Native Alaskan	1.5%	1.5%	1.2%	0.8%	-0.2%
Asian	10.4%	12.1%	12.8%	5.2%	2.4%
Native Hawaiian or Pacific Islander	0.6%	0.6%	0.7%	0.2%	0.1%
Other race	15.3%	15.6%	11.7%	4.8%	-3.6%
Two or more races	5.0%	5.2%	4.9%	3.0%	0.0%
Ethnic Composition					
Hispanic or Latino	30.2%	35.1%	36.1%	18.2%	5.9%

Values do not include the Pacific Island territories due to missing data.

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

The age distribution is relatively similar among States in Region IX, with some exceptions. For instance, the age profile of Hawaii is somewhat "older" than the national average (lower percentage of persons under 18, higher percentage of those over 65). On the other hand, there are substantial differences in racial and ethnic composition within the region, as shown in Table 3-141. California and Hawaii are the most diverse States in the region.

Table 3-141: Age, Racial, and Ethnic Composition of FEMA Region IX by State, 2014

	Arizona	California	Hawaii	Nevada	Pacific Islands	Total for Region IX*
2014						
Age						
Under 18	24.1%	23.6%	21.7%	23.3%	ND	23.6%
Over 65	15.9%	12.9%	16.1%	14.1%	ND	13.4%
Racial Composition						
White	78.3%	61.4%	25.4%	68.0%	ND	63.0%
Black or African American	4.2%	5.8%	2.2%	8.6%	ND	5.7%
American Indian or Native Alaskan	4.4%	0.7%	0.2%	1.1%	ND	1.2%
Asian	3.2%	13.9%	37.6%	7.8%	ND	12.8%
Native Hawaiian or Pacific Islander	0.2%	0.4%	10.4%	0.7%	ND	0.7%
Other race	6.4%	13.2%	1.0%	9.5%	ND	11.7%
Two or more races	3.3%	4.6%	23.3%	4.4%	ND	4.9%
Ethnic Composition						
Hispanic or Latino	30.5%	38.6%	10.1%	27.8%	ND	36.1%

ND: No data available

*Regional values do not include the Pacific Island territories due to missing data.

Source: (USCB, 2014)

3.12.13.9.2 Economic Characteristics

Table 3-142 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014. Per capita income, unemployment, and individuals under the poverty line in Region IX were higher than the national average in 2014. This may be partially attributable to the impacts of the Great Recession on California as a result of the technology industry "bubble." The Pacific Island territories are not included in this table because data for these territories is limited.

Table 3-142: Economic Indicators in FEMA Region IX, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$32,328	$40,974	$47,711	$46,049	$1,661
Annual Average Unemployment	4.8%	11.9%	7.4%	6.2%	1.2%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	13.9%	15.8%	16.5%	15.8%	0.6%

Values do not include the Pacific Island territories due to missing data.

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-143 provides figures on employment percentages by industry sector (not including the Pacific Island territories). Employment by industry sector in Region IX closely mirrors trends experienced at the national level, with losses in manufacturing and gains in education and health services, and professional and business services. In 2014, Region IX had a somewhat higher percentage (greater than 1 percent but less than 2 percent difference) of persons working in "real estate and rental and leasing" and "professional, scientific, and technical services" than did the nation. It had a somewhat lower percentage of workers in "manufacturing" than the nation. In all other industries, Region IX had relatively similar percentages of employment (within 1 percent) to the nation.

Table 3-143: Employment by Industry Sector for FEMA Region IX, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	24,095,358	25,328,827	28,006,798	185,798,800	16.2%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	1.5%	1.1%	1.0%	1.4%	-0.4%
Forestry, fishing, and related activities	0.9%	0.9%	0.9%	0.5%	0.4%
Mining, quarrying, and oil and gas extraction	0.3%	0.4%	0.4%	0.9%	-0.5%
Utilities	0.3%	0.3%	0.3%	0.3%	0.0%
Construction	5.6%	4.5%	4.7%	5.2%	-0.5%
Manufacturing	9.2%	6.1%	5.8%	7.0%	-1.2%
Wholesale trade	3.7%	3.5%	3.4%	3.5%	0.0%
Retail trade	10.3%	9.8%	9.5%	10.1%	-0.5%
Transportation and warehousing	3.0%	2.9%	3.1%	3.4%	-0.3%
Information	2.9%	2.3%	2.3%	1.8%	0.5%
Finance and insurance	4.6%	5.0%	4.8%	5.3%	-0.5%
Real estate and rental and leasing	4.3%	6.1%	5.8%	4.4%	1.4%
Professional, scientific, and technical services	7.2%	8.0%	8.0%	6.9%	1.1%
Management of companies and enterprises	1.5%	1.1%	1.1%	1.3%	-0.1%
Administrative and support and waste management and remediation services	6.7%	6.5%	6.8%	6.3%	0.5%
Educational services	1.4%	2.1%	2.2%	2.4%	-0.2%
Health care and social assistance	7.7%	9.4%	10.7%	11.2%	-0.5%
Arts, entertainment, and recreation	2.4%	2.7%	2.7%	2.2%	0.5%
Accommodation and food services	7.4%	7.9%	8.2%	7.3%	0.9%
Other services (except public administration)	5.6%	5.7%	6.0%	5.9%	0.2%
Government and government enterprises	13.5%	13.7%	12.2%	12.9%	-0.7%

*Figures may not add to 100% due to rounding. Values do not include the Pacific Island territories due to missing data.

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.9.3 Housing Characteristics

Table 3-144 shows key housing indicators for Region IX (not including the Pacific Island territories). The total number of housing units grew substantially from 2000 to 2014, more than the national increase of 15.5 percent. Median home value grew substantially from 2000 to 2014 and in 2014 was considerably higher in Region IX than the national average. The occupancy rate is similar. The home ownership rate is significantly lower in Region IX than nationally. Two factors that contribute to this difference are the high cost of housing in the region, and high rates of in-migration to the region. Many migrants tend to live in rentals for some time, particularly if housing costs are high.

Table 3-144: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region IX 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	15,691,737	18,217,929	18,540,017	135,534,245	18.2%
Median Home Value*	$185,437	$278,002	$347,937	$228,549	87.6%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	92.8%	90.1%	89.9%	87.4%	-2.9%
Percentage of Owner-Occupied Housing Units	58.6%	57.6%	54.9%	63.2%	-3.7%

*Median Home Value represents a simple average of each State's value.
Values do not include the Pacific Island territories due to missing data.

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.9.4 Environmental Justice

Region IX is very racially diverse. As a result, there are numerous counties in all States in the region with 50 percent or more minority populations, particularly in Hawaii, southern California, and eastern Arizona. Counties with 20 percent or more of the population living below the poverty line are also found throughout the region, particularly in eastern Arizona and southern and central California. In addition, there are a number of counties with a poverty rate close to 20 percent; a closer examination of these counties may reveal low-income populations that are not observable using county data (EPA, 2013a). Data were not available for the Pacific Island territories. Available information indicates that there are low-income populations and minority populations throughout the territories.

3.12.13.9.5 Special Flood Hazard Areas

As shown in Table 3-145, the population and housing units of Region IX are disproportionately within coastal SFHAs, and disproportionately outside of riverine SFHAs, relative to the area within each type of SFHA. While only 0.6 percent of the region is located within a coastal SFHA, 1.2 percent of the population and 1.4 percent of the housing units are within a coastal SFHA. Conversely, while 4.4 percent of the region is within a riverine SFHA, only 3.2 percent of the population and 3.3 percent of the housing units are within a riverine SFHA.

Table 3-145: Area, Population, and Housing Units within SFHAs in FEMA Region IX, 2010

	Within SFHA			Region IX
	Coastal	Riverine	Total	Total
Area (Square Miles)	2,210	16,748	18,958	383,484
Percent of Region's Total Area	0.6%	4.4%	4.9%	100.0%
Population	569,297	1,488,283	2,057,580	45,989,182
Percent of Region's Total Population	1.2%	3.2%	4.5%	100.0%
Housing Units	240,545	573,905	814,450	17,532,529
Percent of Region's Total Housing Units	1.4%	3.3%	4.6%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.9.6 Flood Insurance Policies and Premiums

Table 3-146 provides figures on flood insurance policies and premiums in Region IX compared to the nation. The average flood insurance coverage and average premium per year vary significantly within Region IX. The average insurance in the region ranged from $195,358 in the Pacific Islands to $277,940 in California. The regional average premium per year ranged from $619 in Hawaii to $2,076 in the Pacific Islands.

Table 3-146: Flood Insurance Policies and Premiums in FEMA Region IX, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Arizona	35,702	$8,549,954,400	$239,481	$22,445,385	$629
California	285,137	$79,251,051,100	$277,940	$212,569,597	$745
Hawaii	59,962	$13,317,563,300	$222,100	$37,141,898	$619
Nevada	12,914	$3,302,266,700	$255,712	$8,486,508	$657
Pacific Islands	246	$48,058,100	$195,358	$510,722	$2,076
Total for Region IX	393,961	$104,468,893,600	$265,176	$281,154,110	$714
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.9.7 Ecosystem Services

The continental areas of Region IX are characterized primarily by desert scrub/shrublands, with more evergreen and deciduous forests found in eastern and northern California, as well as parts of central Arizona. There is also a large proportion of crop agriculture found in central California (USGS, 2013j). These areas provide services such as erosion control, flood protection, air and water purification, nutrient cycling, carbon sequestration, and groundwater recharge.

3.12.13.9.8 Natural Disasters

From 1990 through September 2013, Region IX had 42 major disaster declarations and 1 emergency declaration involving flooding. Flooding is typically associated with severe storms, mudslides, landslides, and wildfires. Recent events include major disaster declarations in Hawaii in April 2012 due to severe storms, flooding, and landslides; in California in January 2011 due to winter storms, flooding, and debris and mudflows; and in Arizona in December 2010 due to severe storms and flooding. (FEMA, 2013g)

Hawaii and the Pacific Island territories are susceptible to typhoons and tropical storms. In the last 60 years, four hurricanes—Iniki, Iwa, Dot, and Nina—have struck Hawaii. Tropical storms are more frequent (Oskin, 2013). The most recent hurricane, Hurricane Iniki in 1992, caused damages of $1.8B, or over $3B in today's dollars (Blake, Landsea, & Gibney, 2011). The potential effects of storm surges and sea level rise also threaten the Pacific Islands. In 2008, extreme waves and high tides caused widespread flooding in the Marshall Islands' city of Majuro and other urban centers, at 1 meter above sea level. In 2013, heavy waves once again breached the city walls of Majuro. These emergencies, along with drought in the northern atolls of the Marshall Islands, resulted in President Obama signing a disaster declaration for the Marshall Islands (The White House (President Barack Obama), 2013). Finally, low-lying coastal areas of Region IX are also vulnerable to flooding from tsunamis.

3.12.13.9.9 Public Health and Safety Services

Public health and safety services are found throughout the region, although data were not available for Pacific Island territories. The Los Angeles Police Department is the largest law enforcement agency in the region, and the 3rd largest in the country with more than 9,700 full-time sworn personnel. All of the States in Region IX are ranked in the top 25 States with the highest percentage of career or mostly career fire departments. Hawaii has the highest percentage (90.9 percent) in the region and the 2nd highest in the country. California, Arizona, and Nevada are ranked 5th, 7th, and 9th, respectively (FEMA, 2013i). Table 3-147: shows the distribution of public health and safety services within the region.

Table 3-147: Public Health and Safety Services, Region IX

	Arizona	California	Hawaii	Nevada	Total for Region IX
State & Local Law Enforcement Agencies (2008)	140	345	23	38	**546**
Fire Departments (2012)	249	835	11	85	**1,180**
Hospitals (2011)	70	345	23	38	**476**

The Pacific Island territories were not included – data is not available.

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.12.13.10 FEMA Region X

3.12.13.10.1 Population and Demographic Characteristics

The population growth rate in Region X was significantly higher than the national average, attributable particularly to growth in Washington and Oregon associated with the high-tech industries in those higher population States. Table 3-148 details the State-by-State population growth and shows population growth in the region from 2000 to 2015.

Racially, Region X has higher percentages of persons who self-identify as American Indian or Native Alaskan, Asian, Native Hawaiian or Pacific Islander, or of two or more races, than the nation as a whole. However, the regional population is approximately 80 percent white, which is a higher percentage than the national average. The African American population as a percentage of the total population is nearly 10 percent lower in the region than nationally, and the Hispanic population is also comparatively low.

The age distribution is not substantially different from the United States as a whole. Table 3-149 shows the age, racial, and ethnic composition of Region X.

Table 3-148: Total Population of FEMA Region X by State, 2000 – 2015

	Alaska	Idaho	Oregon	Washington	Total for Region X
Total Population 2000	626,932	1,293,953	3,421,399	5,894,121	11,236,405
Total Population 2010	710,231	1,567,582	3,831,074	6,724,540	12,833,427
Change 2000 – 2010	83,299	273,629	409,675	830,419	1,597,022
AARC 2000 – 2010	1.26%	1.94%	1.14%	1.33%	1.34%
Total Population 2015	738,432	1,654,930	4,028,977	7,170,351	13,592,690
Change 2010 – 2015	28,201	87,348	197,903	445,811	759,263
AARC 2010 – 2015	0.78%	1.09%	1.01%	1.29%	1.16%

AARC: Average Annual Rate of Change

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (United Nations, 2015)

Table 3-149: Age, Racial, and Ethnic Composition of FEMA Region X, 2000 – 2014

	Regional Percent of Population in 2000	Regional Percent of Population in 2010	Regional Percent of Population in 2014	U.S. Percent of Population in 2014	Regional Change in Share 2000 – 2014
Age					
Under 18	26.0%	23.9%	23.0%	23.1%	-3.0%
Over 65	11.4%	12.6%	14.4%	14.5%	3.0%
Racial Composition					
White	83.6%	80.0%	80.8%	73.3%	-2.8%
Black or African American	2.4%	2.7%	2.7%	12.6%	0.2%
American Indian or Native Alaskan	2.3%	2.2%	2.0%	0.8%	-0.3%
Asian	4.1%	5.3%	5.8%	5.2%	1.7%
Native Hawaiian or Pacific Islander	0.3%	0.5%	0.5%	0.2%	0.2%
Other race	3.9%	5.0%	3.2%	4.8%	-0.7%
Two or more races	3.4%	4.3%	5.0%	3.0%	1.6%
Ethnic Composition					
Hispanic or Latino	7.5%	11.1%	12.0%	18.2%	4.4%

Sources: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014)

The age distribution is relatively similar among States in Region X, with some exceptions. For instance, the age profile of Oregon is somewhat "older" than the national average (lower percentage of persons under 18, higher percentage of those over 65), whereas the age profile of Alaska is "younger" than the national average. There are also differences in racial and ethnic composition within the region, as shown in Table 3-150. The percentages of American Indians, Native Alaskans, or two or more races are particularly high in Alaska. Washington has a high percentage of Asians.

Table 3-150: Age, Racial, and Ethnic Composition of FEMA Region X by State, 2014

	Alaska	Idaho	Oregon	Washington	Total for Region X
2014					
Age					
Under 18	25.4%	26.4%	21.6%	22.7%	23.0%
Over 65	9.5%	14.4%	16.0%	14.1%	14.4%
Racial Composition					
White	65.6%	91.7%	84.6%	77.7%	80.8%
Black or African American	3.4%	0.7%	1.8%	3.6%	2.7%
American Indian or Native Alaskan	14.0%	1.3%	1.2%	1.4%	2.0%
Asian	6.0%	1.5%	4.0%	7.8%	5.8%
Native Hawaiian or Pacific Islander	1.1%	0.1%	0.4%	0.6%	0.5%
Other race	1.4%	2.2%	3.6%	3.5%	3.2%
Two or more races	8.5%	2.5%	4.5%	5.4%	5.0%
Ethnic Composition					
Hispanic or Latino	6.7%	12.0%	12.5%	12.2%	12.0%

Source: (USCB, 2014)

3.12.13.10.2 Economic Characteristics

Table 3-151 shows the change over time of per capita income, unemployment, and poverty within the region, and compares regional to national figures for 2014. Per capita income in Region X was slightly lower than the national average in 2014. The percentage of unemployment in the region was similar to the national rate in 2014. The percentage of individuals below the poverty level was lower than the national rate.

Table 3-151: Economic Indicators in FEMA Region X, 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Value Compared to U.S. Value in 2014
Per Capita Income	$30,706	$39,684	$45,796	$46,049	-$253
Annual Average Unemployment	5.2%	9.9%	6.3%	6.2%	0.1%
Poverty Rate (Percentage of Individuals Below the Poverty Level)	11.0%	14.2%	14.3%	15.8%	-1.6%

Sources: (Bureau of Economic Analysis, 2016a) (Bureau of Labor Statistics, 2016) (U.S. Census Bureau, 2003) (U.S. Census Bureau, 2010)

Table 3-152 provides figures on employment percentages by industry sector. In 2014, Region X had a somewhat higher percentage of health services, and professional and business services. In 2014, Region IX had a somewhat higher percentage (greater than one but less than two percentage points difference) of persons working in "government and government enterprises" than did the nation. It had a somewhat lower percentage of workers in "finance and insurance" and "administrative and support and waste management and remediation services" than the nation. In all other industries, Region X had relatively similar percentages of employment (within one percentage point) to the nation.

Table 3-152: Employment by Industry Sector for FEMA Region X, 2000 – 2014

	Regional Total Jobs in 2000	Regional Total Jobs in 2010	Regional Total Jobs in 2014	U.S. Total Jobs in 2014	Regional Percent Change from 2000 – 2014
Total Jobs, all industries	6,782,331	7,246,780	7,774,190	185,798,800	14.6%
	Regional Percentage of Total Jobs in 2000*	**Regional Percentage of Total Jobs in 2010***	**Regional Percentage of Total Jobs in 2014***	**U.S. Percentage of Total Jobs in 2014***	**Regional Value Compared to U.S. Value in 2014**
Farm employment	2.8%	2.6%	2.4%	1.4%	1.0%
Forestry, fishing, and related activities	1.4%	1.3%	1.3%	0.5%	0.8%
Mining, quarrying, and oil and gas extraction	0.4%	0.5%	0.6%	0.9%	-0.3%
Utilities	0.2%	0.2%	0.2%	0.3%	-0.1%
Construction	6.1%	5.2%	5.3%	5.2%	0.1%
Manufacturing	9.9%	7.2%	7.6%	7.0%	0.6%
Wholesale trade	3.7%	3.4%	3.4%	3.5%	-0.1%
Retail trade	11.5%	10.3%	10.4%	10.1%	0.3%
Transportation and warehousing	3.2%	3.0%	3.1%	3.4%	-0.2%
Information	2.5%	2.4%	2.3%	1.8%	0.6%
Finance and insurance	3.8%	4.0%	3.9%	5.3%	-1.4%
Real estate and rental and leasing	3.6%	4.5%	4.3%	4.4%	-0.1%
Professional, scientific, and technical services	5.8%	6.7%	6.7%	6.9%	-0.2%
Management of companies and enterprises	1.0%	1.0%	1.2%	1.3%	-0.1%
Administrative and support and waste management and remediation services	4.9%	5.0%	5.1%	6.3%	-1.2%
Educational services	1.3%	2.0%	2.0%	2.4%	-0.4%
Health care and social assistance	8.6%	10.7%	11.2%	11.2%	0.0%
Arts, entertainment, and recreation	2.0%	2.3%	2.3%	2.2%	0.1%
Accommodation and food services	6.4%	6.6%	6.9%	7.3%	-0.3%
Other services (except public administration)	5.2%	5.1%	5.2%	5.9%	-0.7%
Government and government enterprises	15.6%	16.0%	14.5%	12.9%	1.6%

*Figures may not add to 100% due to rounding

Source: (Bureau of Economic Analysis, 2016b)

3.12.13.10.3 Housing Characteristics

Table 3-153 shows key housing indicators for Region X. The total number of housing units grew considerably from 2000 to 2014, more than the national increase of 15.5 percent. Median home values grew considerably from 2000 to 2014, and in 2014 home values were similar to the national average. The overall occupancy rate and percentage of owner-occupied units were consistent with national averages.

Table 3-153: Total Housing Units, Percentage of Owner-Occupied Units, and Median Home Value in FEMA Region X 2000 – 2014

	Regional Value in 2000	Regional Value in 2010	Regional Value in 2014	U.S. Value in 2014	Regional Percent Change from 2000 – 2014
Total Housing Units	4,692,586	5,536,002	5,657,573	135,534,245	20.6%
Median Home Value*	$139,207	$204,353	$226,597	$228,549	62.8%
-	-	-	-	-	**Regional Change in Share 2000 – 2014**
Percentage of Housing Units Occupied	91.6%	89.9%	89.4%	87.4%	-2.2%
Percentage of Owner-Occupied Housing Units	65.2%	64.0%	62.2%	63.2%	-3.0%

* Median Home Value represents a simple average of each State's value

Source: (U.S. Census Bureau, 2000b) (U.S. Census Bureau, 2010) (USCB, 2014) (Federal Housing Finance Agency, 2010) (Federal Housing Finance Agency, 2016)

3.12.13.10.4 Environmental Justice

Counties with 50 percent or greater minority populations in Region X are found predominantly in Alaska, although Yakima, Adams, and Franklin Counties in south-central Washington also have minority populations greater than 50 percent. There are substantial portions of all States in the region with 20 percent or more of their population living below the poverty level, as well as counties where the poverty rate at the county level is close to 20 percent. In these counties, it is likely that there are communities with a poverty rate at or above 20 percent that are not observable with county data. This indicates that there are potentially low-income communities and minority communities throughout the region. (EPA, 2013a)

3.12.13.10.5 Special Flood Hazard Areas

Table 3-154 shows that the housing units of Region X are proportionately within coastal SFHAs, and its population and housing units are disproportionately within riverine SFHAs, relative to the area within SFHAs. Specifically, 0.8 percent of the region is located within a coastal SFHA and the same percentage of its housing units is within a coastal SFHA. Although 3.7 percent of the region is located within a riverine SFHA, 4.0 percent of the population and 4.6 percent of housing units are located there.

Table 3-154: Area, Population, and Housing Units within SFHAs in FEMA Region X, 2010

	Within SFHA			Region X
	Coastal	Riverine	Total	Total
Area (Square Miles)	1,920	7,354	9,274	249,584
Percent of Region's Total Area	0.8%	2.9%	3.7%	100.0%
Population	68,986	417,822	486,807	12,123,227
Percent of Region's Total Population	0.6%	3.4%	4.0%	100.0%
Housing Units	43,413	194,941	238,354	130,980,270
Percent of Region's Total Housing Units	0.8%	3.7%	4.6%	100.0%

Source: FEMA analysis using National Flood Hazard Layer (FEMA, 2016) and 2010 Census data

3.12.13.10.6 Flood Insurance Policies and Premiums

Table 3-155 provides figures on flood insurance policies and premiums in Region X compared to the nation. The average flood insurance coverage is substantially the same within Region X as in the rest of the country; however, the regional average premium per year is higher than the national average. The average premium per year ranged from $720 in Idaho to $879 in Alaska.

Table 3-155: Flood Insurance Policies and Premiums in FEMA Region X, 2015

State	Number of Policies	Total Insurance	Average Insurance	Total Premium per Year	Average Premium per Year
Alaska	2,795	$716,529,900	$256,361	$2,456,171	$879
Idaho	6,193	$1,450,034,400	$234,141	$4,457,245	$720
Oregon	30,764	$7,356,124,100	$239,115	$25,652,496	$834
Washington	39,872	$9,683,450,600	$242,863	$34,420,263	$863
Total for Region X	79,624	$19,206,139,000	$241,210	$66,986,175	$841
United States	5,108,870	$1,241,683,433,500	$243,045	$3,545,092,390	$694

Source: (FedCenter, 2015)

3.12.13.10.7 Ecosystem Services

The more rural areas of Region X are dominated by evergreen and deciduous forests in western Oregon, Washington, northern Idaho, and southern and central Alaska. Northern Alaska is characterized by arctic tundra containing dwarf shrublands, lichens, mosses, and other characteristic plant communities. These natural communities provide services such as flood protection, air and water purification, erosion control, groundwater recharge, carbon sequestration, and others.

3.12.13.10.8 Natural Disasters

From 1990 through September 2013, Region X had 42 major disaster declarations involving flooding. Floods were primarily associated with severe storms, landslides, mudslides, heavy snow, and ice jams. Recent events include major disaster declarations in Alaska in June 2013 and November 2012 due to flooding, severe storms, and landslides, and in Washington in August and January 2012 due to severe storms, winds, landslides, and flooding. Low-lying coastal areas of Region X are also vulnerable to flooding from tsunamis. (FEMA, 2013g)

In December 2007, a series of storms from the Pacific hit Washington and Oregon. Rainfall combined with snowmelt produced record flooding in western portions of these States. Eleven deaths resulted, and estimated damages exceeded $1B. Several communities were inundated and some portions were completely destroyed. (National Weather Service, 2008)

Major oceanic storms, such as the November 2011 Bering Sea superstorm, can be particularly damaging in Alaska since most development, infrastructure, and transportation facilities are on the coasts. If these facilities are damaged, the ability to provide relief supplies and assistance may be further challenged due to more limited transportation options and difficulty accessing remote coastal communities. The 2011 superstorm struck the western Alaska coastline with winds of up to 93 mph. Storm surges of up to 40 feet, and sea levels rising almost 9 feet above normal flooded low-lying coastal communities. Damages were estimated to be over $24M. (NOAA, 2011b)

3.12.13.10.9 Public Health and Safety Services

Public health and safety services exist throughout the region, although their availability varies tremendously by location, particularly in remote or rural areas of the region. The Seattle Police Department is the largest law enforcement department in the region, with more than 1,200 sworn full-time personnel (Seattle Police Department, 2009). Idaho has the highest percentage of volunteer or mostly volunteer fire departments in the region (90.0 percent), and Washington has the highest percentage of career or mostly career departments (20 percent) (FEMA, 2013i). Table 3-156 shows the distribution of public health and safety services throughout the region.

Table 3-156: Public Health and Safety Services, Region X

	Alaska	Idaho	Oregon	Washington	Total for Region X
State & Local Law Enforcement Agencies (2008)	50	117	174	260	**601**
Fire Departments (2012)	145	181	297	402	**1,025**
Hospitals (2011)	23	40	59	85	**207**

Sources: (Bureau of Justice Statistics, 2011) (FEMA, 2013i) (American Hospital Association, 2013)

3.13 CLIMATE CHANGE

Unit of Analysis
NOAA NCDC Regions

3.13.1 Definition of the Resource

"Climate change" is defined as "a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer." It refers to any change in climate over time, whether due to natural variability or human activity (IPCC, 2007).

Accelerated rates of climate change are linked to an increase in greenhouse gas (GHG) emissions caused by human activities such as burning fossil fuels to generate electricity (EPA, 2012q). The Intergovernmental Panel on Climate Change (IPCC) is now 95 to 100 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: CO_2, methane (CH_4), N_2O, and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e), which equalizes for the different global warming potential of each type of GHG.

Global concentrations of these four GHGs have increased significantly since 1750. Atmospheric concentrations of CO_2 increased from 280 ppm of carbon in 1750 to 404 ppm of carbon in 2016 (EPA, 2016f) (NOAA, 2017). The atmospheric concentration of CH_4 has more than doubled since pre-industrial times, reaching approximately 1,800 ppb in recent years (i.e., 2013 and 2014). Atmospheric concentrations of N_2O increased from a pre-industrial value of about 270 ppb to 326 ppb in 2014 (EPA, 2016f). Many halocarbons have increased from a near-zero pre-industrial concentration, primarily due to human activities (IPCC, 2007).

This section will focus the discussion of climate change on the following areas: 1) temperature; 2) precipitation; 3) sea level; 4) streamflow; and 5) extreme events (including tropical storms, tropical cyclones, and hurricanes). The unit of analysis for this section, NOAA NCDC Regions, was chosen to focus the discussion of climate change on areas with similar precipitation and temperature characteristics.

3.13.2 Applicable Statutes and Regulations

The alternatives must meet the requirements of NEPA, and other applicable laws and regulations. A discussion of the applicable laws and regulations for Climate Change are provided below.

3.13.2.1 EO 13653 (Preparing the United States for the Impacts of Climate Change)

Signed on November 1, 2013, EO 13653, *Preparing the United States for the Impacts of Climate Change*, requires Federal agencies to reform their programs, policies, rules, and operations to improve agency preparedness and resilience to climate change. The legislation mandates that agencies develop, implement, and update comprehensive plans to take into consideration climate change. In addition, the EO requires agencies to report on progress made to Agency Adaptation Plans that identify and evaluate climate change related impacts on and risk to the agency's operations and mission. (EPA, 2016g)

As a condition of this EO, FEMA is required to evaluate and identify "proposed and completed changes to their land-and-water related policies, programs, and regulations to necessary to make the Nation's watersheds, natural resources, and ecosystems, and the communities and economies that depend on them, more resilient in the face of a changing climate" (The White House, 2013).

3.13.2.2 EO 13693 (Planning for Federal Sustainability in the Next Decade)

Signed on March 19, 2015, EO 13693, *Planning for Federal Sustainability in the Next Decade*, requires Federal agencies to increase efficiency and improve their environmental performance. Specifically, the EO prioritizes reducing energy use and cost, and then finding renewable or alternative energy sources. The legislation requires Federal agencies to achieve the following:

- Greenhouse gas emission reduction;
- Energy conservation and renewable energy;
- Green building performance;
- Water use efficiency and management;
- Fleet efficiency and management;

- Sustainable employee commuting and workplace travel;
- Climate change resiliency;
- Sustainable acquisition;
- Solid waste diversion and pollution prevention;
- Performance contracting;
- Electronics stewardship; and
- Develop, implement, and annually update a Strategic Sustainability Performance Plan. (EPA, 2016h)

As part of daily activities and long-term planning, agencies should:

- "Ensure regional agency actions consider and are consistent with, sustainability and climate preparedness priorities of States, local governments, and tribal communities where agency facilities are located;
- Include in the planning for new buildings or leases cost-effective strategies to optimize sustainable space usage and consideration of existing community transportation planning and infrastructure, including access to public transit;
- Ensure that all new construction, major renovation, repair, and alteration of agency buildings includes appropriate design and deployment of fleet charging infrastructure;
- Include the incorporation of climate-resilient design and management elements into the operation, repair, and renovation of existing agency buildings and the design of new agency buildings;
- Ensure, beginning in fiscal year 2020 and thereafter, that all new construction of Federal buildings greater than 5,000 gross square feet that enters the planning process is designed to achieve energy net-zero and, where feasible, water or waste net-zero by fiscal year 2030" (FedCenter, 2015).

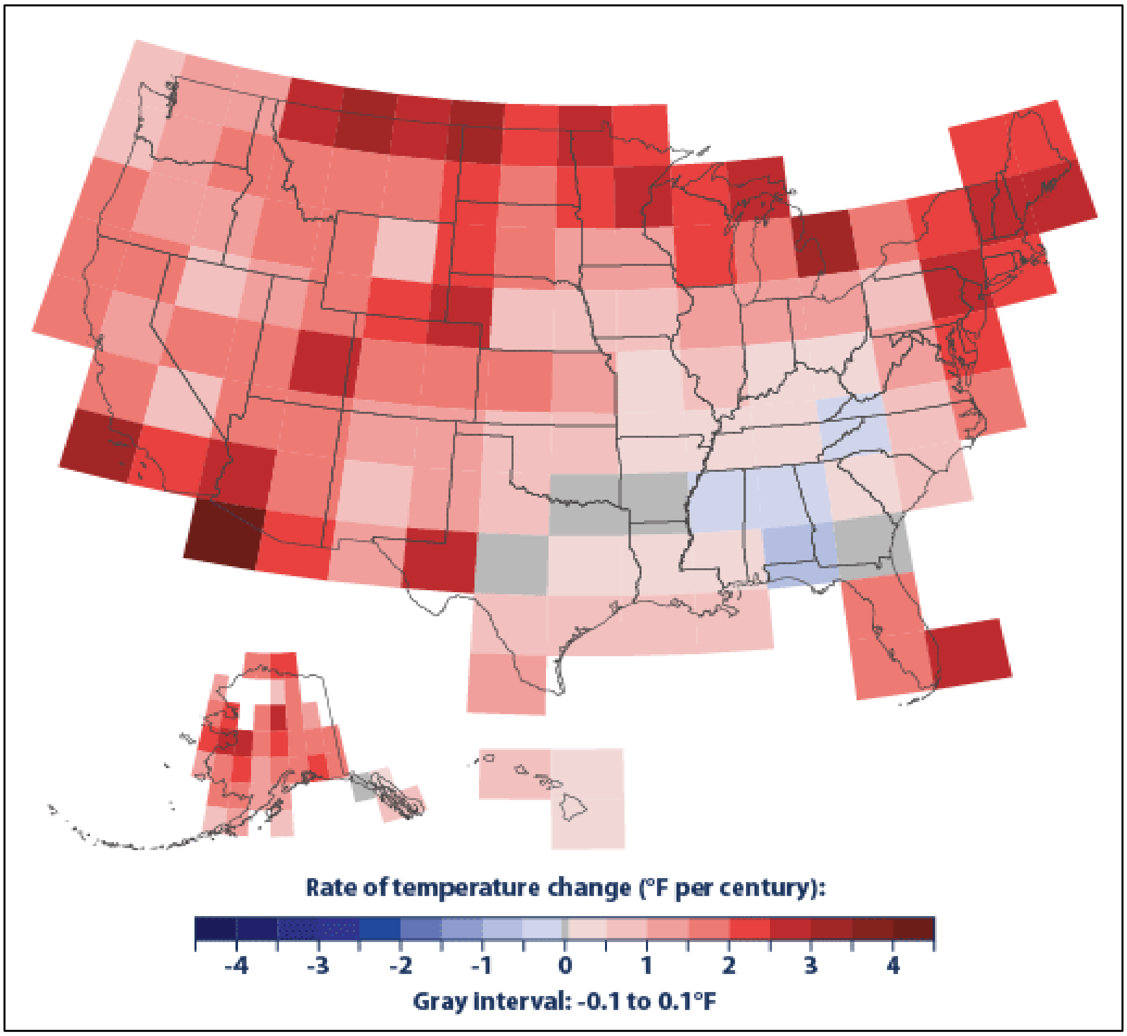
3.13.3 Existing Conditions—Nationwide

Global and national climate change impacts such as temperature change; sea level rise; changes in streamflow; and extreme events, have and will continue to contribute to flooding or drought in some regions and other changes to the nation's water resources and landscape. The year-round average air temperature of the continental United States has already risen by more than 2° F since the 1950s, and is projected to increase in the future as much as 11° F if emissions follow higher scenarios associated with the continued use of fossil fuels (U.S. Global Change Research Program, 2009) (Melillo, Richmond, & Yohe, 2014). Additionally, the past three decades have been the hottest since the start of the Industrial Revolution in 1850 (Fears D. , 2013). Some other impacts of climate change include heat waves that are more frequent, high-intensity precipitation events, sea level rise, more prolonged droughts, and more acidic ocean waters, among others. In addition, the intensity of very heavy precipitation events has increased across the United States over the last 50 years, and continued increases in both frequency and intensity of the heaviest downpours are projected in the future (U.S. Global Change Research Program, 2009) (Melillo, Richmond, & Yohe, 2014). These climate change effects pose challenges to water resources, ecosystems, people, and infrastructure.

3.13.3.1 Temperature

The average surface temperature since 1901 across the contiguous 48 States has risen at an average rate of 0.13° F per decade, or 1.4° F per century (EPA, 2015j). Since the late 1970s, average temperatures have risen more quickly, with an increase of 0.36 to 0.55° F per decade (EPA, 2012q). Since 1990, 7 of the 10 warmest years on record have occurred within the 48 contiguous States. The warmest year on record in the United States since 1895 was 2012 and the second warmest year was 2016 (EPA, 2016i) (NOAA, 2017).

Figure 3-43 shows that long-term temperature changes are variable in the nation. Northern and western States have generally experienced temperature increases, while some parts of the Southeast have experienced little change. (EPA, 2015j)

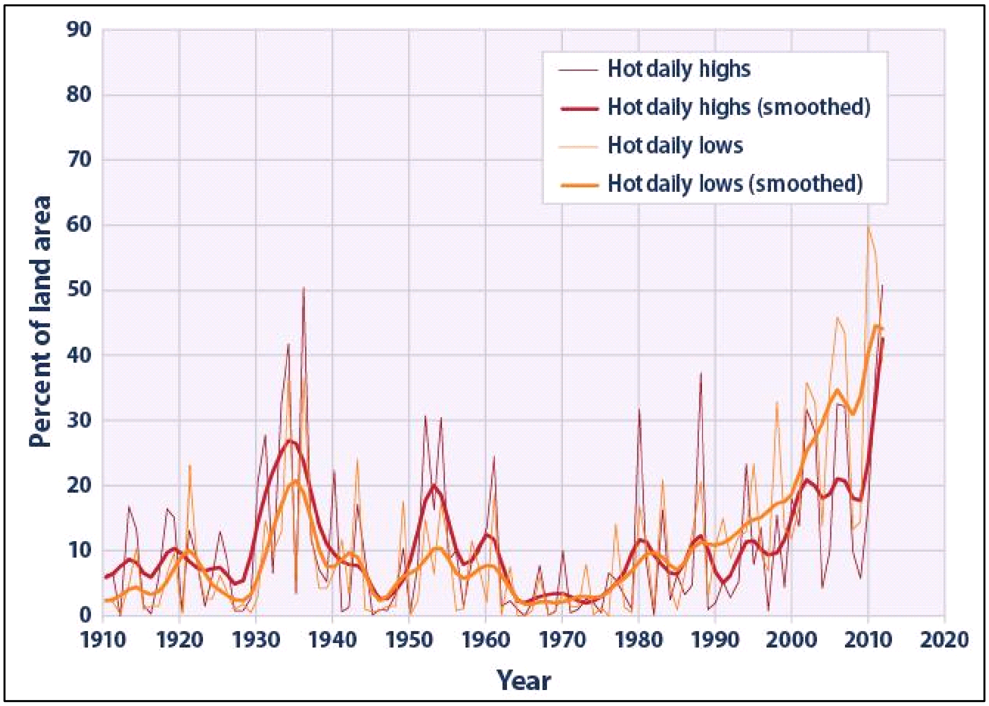


Source: (EPA, 2015j)

Figure 3-43: Rate of Temperature Change in the United States, 1901 – 2012

Global temperatures for 2012 were not record setting, but they remained above the 1981-2010 average, ranking among the top 10 warmest years on record since recordkeeping began in the mid-to-late 1800s (Blunden & Arndt, 2013). The year 2016 was the warmest on record globally and the third year in a row that record was broken (NASA, 2017).

Figure 3-44 shows the percentage of land area within the contiguous 48 States with unusually hot summers from 1910-2012. The graph shows daily high and low temperatures during summer (the months of June, July, and August). The thin lines represent individual years, while the thick lines show a nine-year weighted average. Red lines represent daily highs, while orange lines represent daily lows.



Source: (EPA, 2015j)

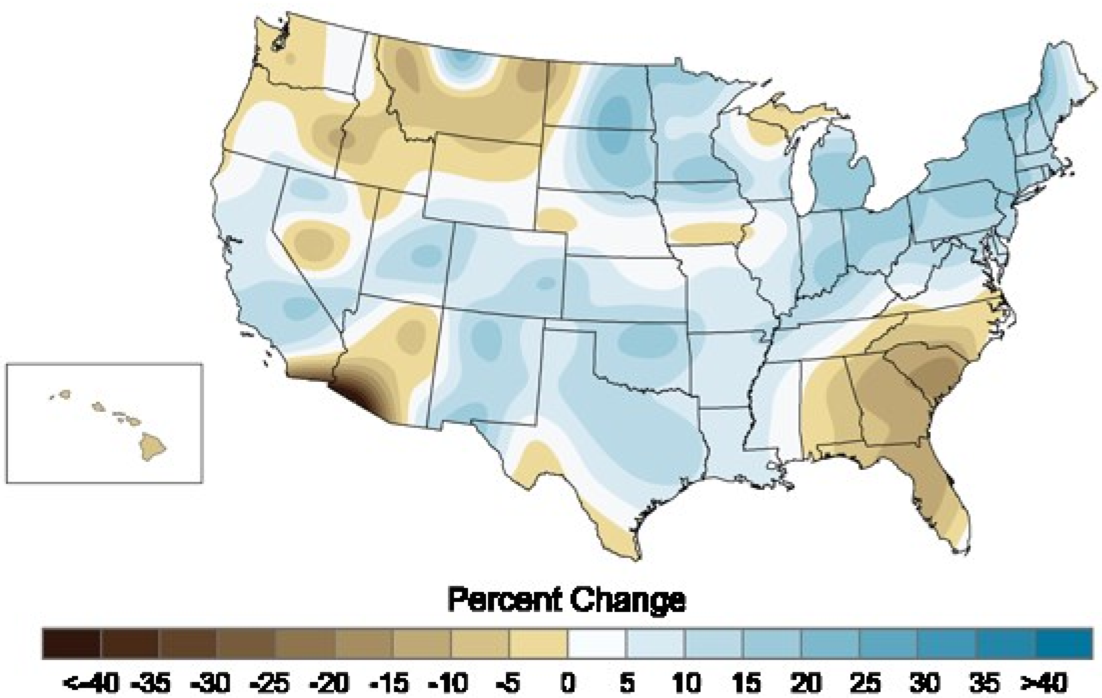
Figure 3-44: Area of the Contiguous 48 States with Unusually Hot Summer Temperatures, 1910 – 2012

According to data from the EPA, there has been an increase in both unusually high day- and night-time temperatures in the summer, with the incidents of higher nighttime temperatures increasing at a faster rate than overall temperature increases. This observation indicates that there is less cooling happening at night. (EPA, 2015j)

Heat waves can directly affect human health by causing illness and death, especially among vulnerable populations such as the young and elderly (EPA, 2015j). Increasing temperatures also affect the physical environment in many ways. One example is that warmer temperatures may increase the proliferation of insects, weeds, and diseases which can lead to declines in crop and livestock production and increase the vulnerability of many forests (U.S. Global Change Research Program, 2009) (Melillo, Richmond, & Yohe, 2014). In addition, increased temperatures influence many other climate change impacts. For instance, increasing surface temperatures can lead to rising ocean temperatures, which influence atmospheric circulation patterns and availability of moisture in the air, thereby altering precipitation patterns (U.S. Global Change Research Program, 2009) (Melillo, Richmond, & Yohe, 2014). These temperature increases can also lead to glacial melting, which contributes to sea level rise.

3.13.3.2 Precipitation

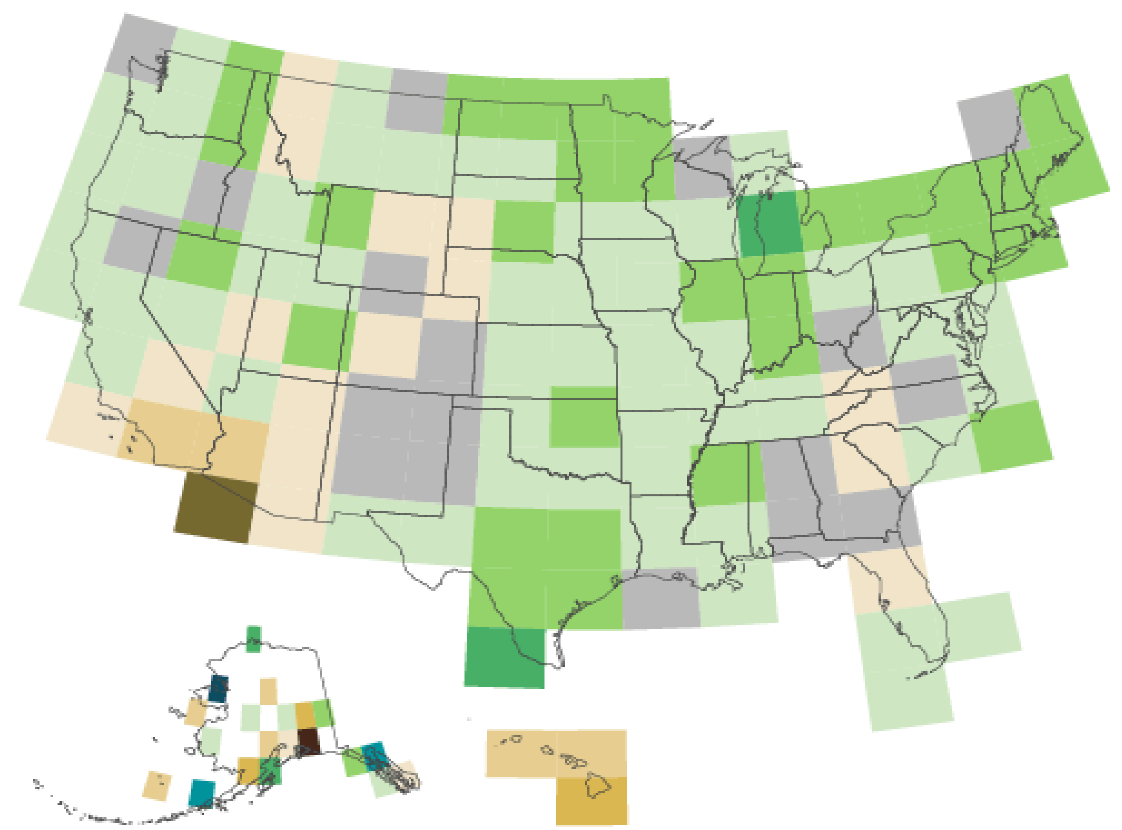
As average temperatures at the Earth's surface rise, more evaporation occurs, which, in turn, increases overall precipitation. Therefore, precipitation is expected to increase in many areas due to warmer temperatures from climate change. Figure 3-45 below shows the amount by which precipitation is expected to increase in the United States. The map shows rainfall percent increases in the amount of falling precipitation in very heavy events (defined as the heaviest 1 percent of all daily events) from 1958 to 2008 for each region. (U.S. Global Change Research Program, 2009)



Source: (U.S. Global Change Research Program, 2009)

Figure 3-45: Increases in Amounts of Very Heavy Precipitation, 1958 – 2008

As shown in the map, there are clear trends toward very heavy precipitation for the nation as a whole, and particularly in the Northeast and Midwest. However, there are also expected decreases in precipitation in some regions, especially in the southern and northwest regions, and climate models forecast continued increases in the heavier downpours with a decrease in lighter precipitation events. Winter and spring precipitation is forecasted to increase in the northern United States and decrease in the Southwest over this century. Although the United States has seen increases in total precipitation (an increase of 7 percent in the past century), the amount of precipitation falling in the heaviest 1 percent of rain events has increased by 20 percent (U.S. Global Change Research Program, 2009) (Melillo, Richmond, & Yohe, 2014) . Figure 3-46 shows that while precipitation has increased from 1901 to 2012 across the United States, regio nal variability is a major factor in precipitation changes.



Source: (EPA, 2012q)

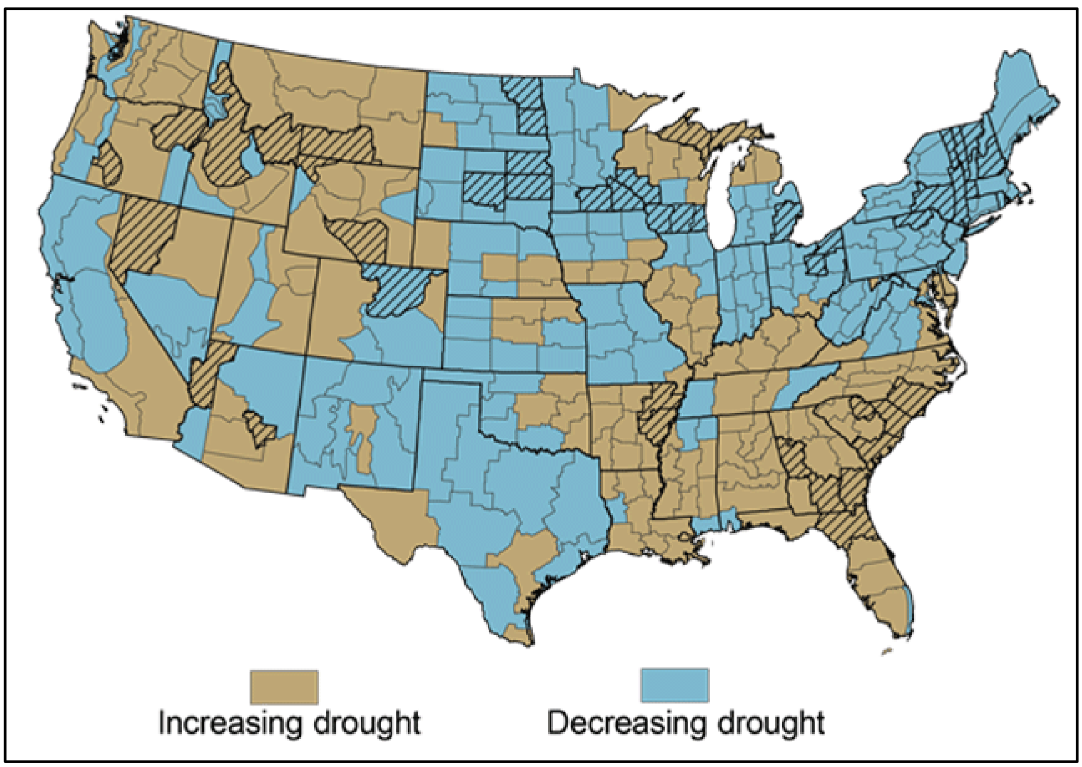
Figure 3-46: Observed Change in Annual Average Precipitation, 1901 – 2012

As shown in the map, the total annual precipitation has increased in the United States since 1901, at a rate of 5 percent per century while the global increase rate was approximately 2 percent per century. Per statistical analysis, this increase in precipitation is considered significant to a 95 percent confidence level. (EPA, 2015j)

Increased preciptiation could contribute to the potential risk of inland flooding. A study by Mallakpour and Villarini indicated an increased frequency of inland flooding due to increaesd precipitation (Mallakpour & Villarini, 2015). A study by Slater and Villarini identified a potential shift in regional flooding patterns and frequency tied to increased precipitation events (Slater & Villarini, 2016).

Heavy rains can affect human health including direct injuries and increased incidence of waterborne disease. Heavier rains can cause flooding, which can lead to sewage overflow and contaminated drinking water. Floods also affect infrastructure within cities by causing property damage, resulting in increased cleanup and rebuilding costs for businesses and homeowners. Much of the existing infrastructure is designed for the historical 100-year flood event. However, cities are likely to experience this same flood level much more frequently as a result of projected climate change over this century leading to greater property damage and a heavier burden on emergency management (U.S. Global Change Research Program, 2009). This increase in flood events poses an even bigger challenge for much of the United States stormwater infrastructure, which is designed for the 10-year storm event (Center for Watershed Protection, 2014). The resulting increased flood risk poses challenges to society including socioeconomic consequences, which could include business interruptions among others. Increases in the frequency and severity of floods are also projected to adversely affect sustainable development (IPCC, 2007).

While many areas have seen an increase in precipitation, some areas far from storm tracks, where storm tracks are narrow zones in seas and oceans where storms travel driven by the prevailing winds, are likely to experience less precipitation and increased risk of drought. As a result, since the 1950s, some regions of the world have experienced longer and more intense droughts (Figure 3-47). Average drought conditions across the nation have varied since records began in 1895. The 1930s and 1950s saw the most widespread droughts, while the last 50 years have generally been wetter than average. Over the period from 2000 through 2012, roughly 30 to 70 percent of the United States land area experienced conditions that were at least abnormally dry at any given time. The years 2002, 2003, 2007, and 2012 were relatively high drought years. In 2012, the United States experienced the driest conditions in more than a decade. During the latter half of 2012, more than half of the United States land area was covered by moderate or greater drought. In several States, 2012 was among the driest years on record. (EPA, 2012q)



Source: (U.S. Global Change Research Program, 2009)

Figure 3-47: Observed Drought Trends (1958-2007)

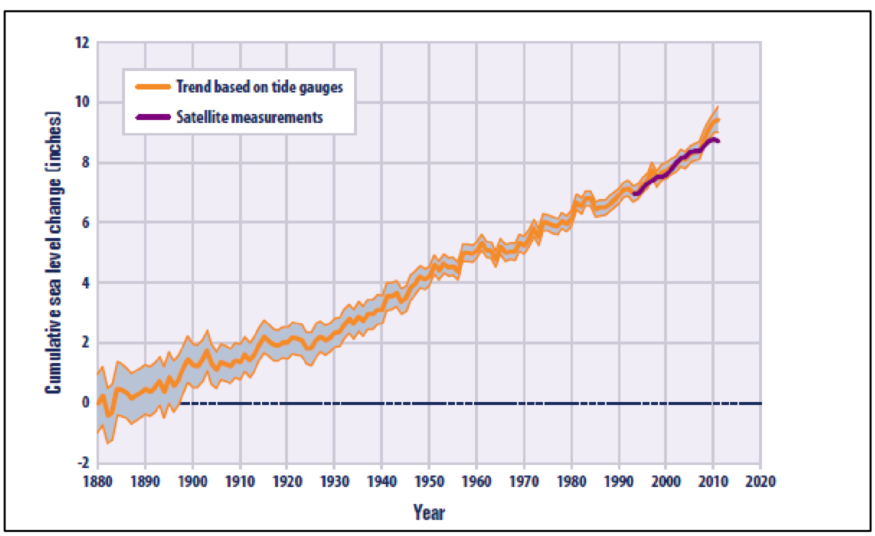
Drought can have many impacts on communities and infrastructure. Droughts can increase the susceptibility to wildfires, which also affects air quality within affected communities. Additionally, wildfires can affect transportation infrastructure directly, produce road closures, increase mudslides, and affect river shipping routes. (U.S. Global Change Research Program, 2009)

3.13.3.3 Sea Level

Sea level rise is an effect of climate change. Several variables lead to sea level rise, such as glacier melt and increasing ocean temperatures resulting in thermal expansion. Worldwide, glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level. When water warms, it also expands, which contributes to sea level rise in the world's oceans. Several studies have shown that the amount of heat stored in the ocean has increased substantially since the 1950s. Ocean heat content not only determines sea surface temperature, but also affects sea level and currents. (EPA, 2012q)

After a period of 2,000 years of little change, global average sea level rose throughout the 20th century. Since 1870, global sea level has risen by approximately 7.5 inches. In recent years, the rate of sea level change has accelerated. When averaged over all the world's oceans, absolute sea level increased at an average rate of 0.07 inches per year from 1880 to 2011. From 1993 to 2011, average sea level rose at the rate of 0.11 to 0.13 inches per year, almost twice as much as the long-term trend (EPA, 2012q). Average global sea levels are expected to rise 1 to 4 feet by 2100 (Melillo, Richmond, & Yohe, 2014).

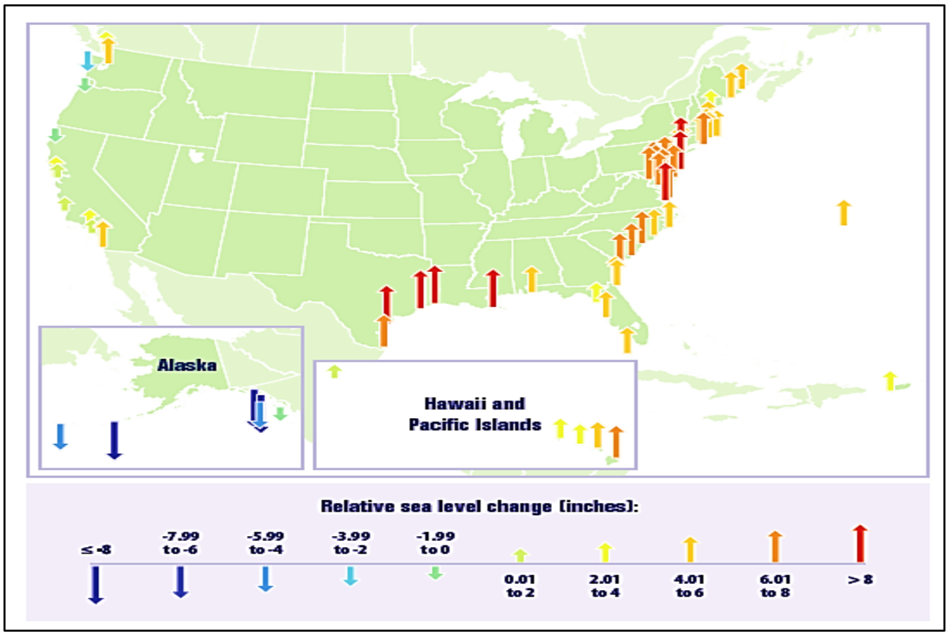
Figure 3-48 displays the global absolute sea level change in inches from 1880-2011. This data is based on a combination of long-term tide gauge measurements and recent satellite measurements. This figure shows average absolute sea level change, which refers to the height of the ocean surface, regardless of whether nearby land is rising or falling. Since the last ice age, the ocean floor has gradually been sinking ever so slightly, which can affect the sea level relative to the coast (EPA, 2012q). Absolute sea level has continued to steadily rise with an absolute cumulative sea level change of 10 inches over the last century.



Source: (EPA, 2012q)

Figure 3-48: Global Average Absolute Sea Level Change, 1880 – 2011

Relative sea level reflects changes in sea level as well as changes in land elevation. Figure 3-49 shows how relative sea level rose along the coastal United States between 1960 and 2011, particularly the Mid-Atlantic coast and parts of the Gulf of Mexico, where some stations registered increases of more than 8 inches. Meanwhile, relative sea level fell at some locations, such as in Alaska, because of an increase in land elevation. (EPA, 2012q)



Source: (EPA, 2012q)

Figure 3-49: Relative Sea Level Change along United States, 1960 – 2011

As reported in NOAA Technical Report *Global and Regional Sea Level Rise Scenarios for the United States*, Western and Eastern U.S. coastlines may be impacted by different regional sea level rise patterns. In the Pacific, the Western Pacific and U.S. Pacific Islands have higher sea level rise rates than the global rate (>10mm/year), whereas the Eastern Pacific and U.S. West Coast are lower (<1mm/year). These differences are attributed to "prevailing trade wind forcing" associated with a large-scale phase switch in Pacific Decadal Oscillation.[58] In the Northeast Atlantic, sea level trends have been higher than the global rate since 2009 and are mainly attributed to changes in the Gulf Stream; however, scientists are uncertain if this is a long-term change or part of natural variability. (NOAA, Global and Regional Sea Level Rise Scenarios for the United States, 2017a)

This sea level rise is already affecting the environment and human lives and will continue to make significant impacts in the future. Currently, a substantial portion of the United States population lives on the coast. However, sea level rise will affect where humans live, and may lead to property and infrastructure destruction with increased costs to fix damages or build homes and businesses further from the coasts. "Rising sea levels are likely to lead to direct losses, such as equipment damage from flooding or erosion, and indirect effects, such as the costs of raising vulnerable assets to higher levels or building

[58] Pacific Decadal Oscillation: "a long-lived El Niño-like pattern of Pacific climate variability" (NOAA, Pacific Decadal Oscillation, 2017b).

new facilities farther inland, increasing transportation costs." Additionally, a significant fraction of America's energy infrastructure is near the coasts, including oil refineries (U.S. Global Change Research Program, 2009). Tidal flooding is projected to increase in the near-term. An analysis by Dahl et al. indicates that "long before areas are permanently inundated, the steady creep of sea level rise will force many communities to grapple with chronic high tide flooding in the next 15 to 30 years" (Dahl, Fitzpatrick, & Spanger-Siegfried, 2017). Another study forecasted that 13.1 million people in U.S. coastal areas would be at risk of flooding from sea level rise by 2100 (Hauer & Evans, 2016).

3.13.3.4 Streamflow

Streamflow is a measure of the amount of water carried by rivers and streams (EPA, 2012q). Streamflow varies over the course of a year depending on different factors such as rainfall and snowmelt, which causes high streamflow. The amount of streamflow is important because very high flows can cause damaging floods. Increased precipitation can increase the volume of snowpack, and warmer temperatures can cause earlier spring melting, both of which can lead to higher streamflow (EPA, 2012q). Furthermore, extreme weather events like severe thunderstorms, which are exacerbated by climate change, can lead to larger peak flows (EPA, 2012q). Additionally, a study for FEMA found that the magnitude of 100-year floods is projected to grow by about 45 percent by 2100, and that 70 percent of this projected growth is due to climate change (AECOM, 2013). However, more frequent or severe droughts will reduce streamflow in certain areas (EPA, 2012q).

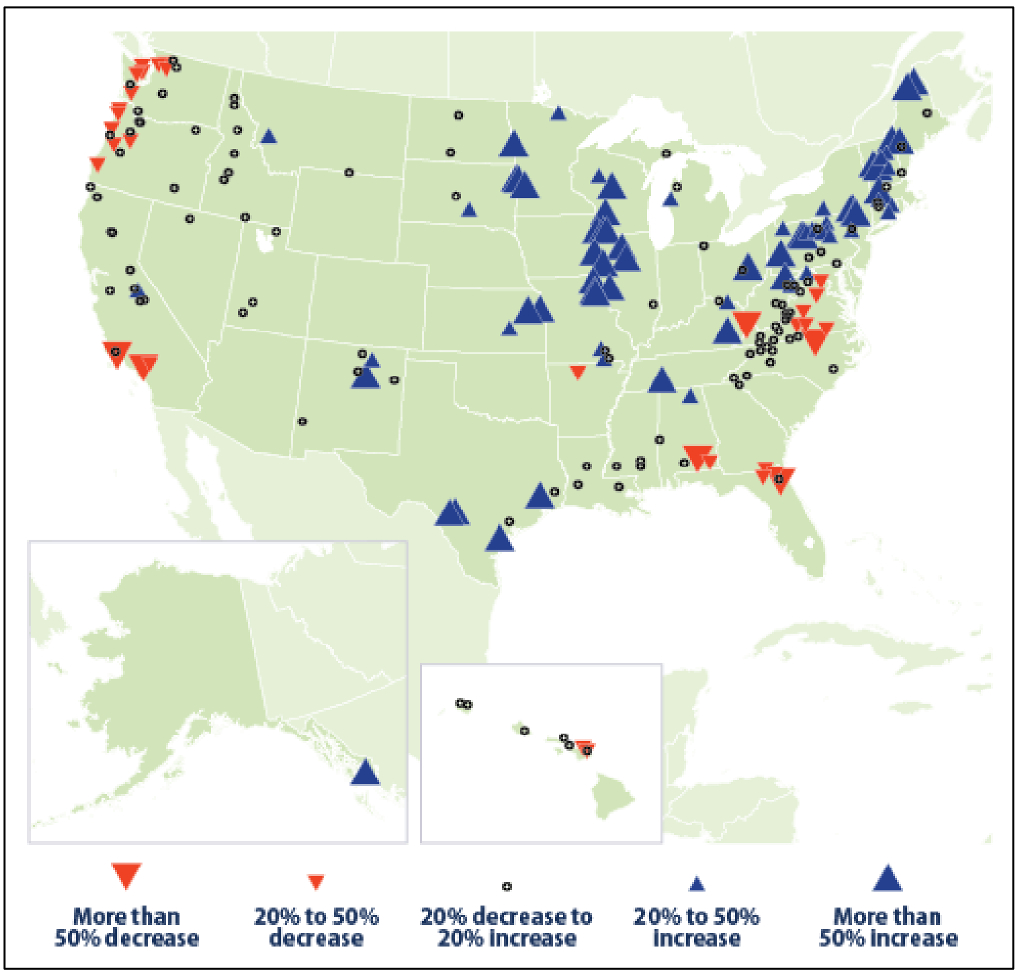
In May 2015, FEMA completed an analysis to estimate future base flood discharges, accounting for climate change and population change in the continental United States (Internal FEMA report, 2015). Specifically, the study evaluated whether NFIP policyholders would experience greater and more frequent riverine and coastal flooding due to rising sea level and more frequent and more intense extreme weather events caused by a changing climate. After applying regional regression equations to data from more than 7,000 stream gages (with 20 or more years of annual peak flow records) across 18 HUC-2 watersheds, under two climate GHG model scenarios, the FEMA researchers presented:

- A defensible, peer-reviewed method for calculating flooding associated with the peak 1-percent-annual-chance riverine flows in calendar year 2060 across the continental United States;
- Summaries of the methodology, data, and development of the climate-discharge regression equations for the HUC-2 regions; and
- The 2060 peak flow estimates computed using the four Global Circulation Models (GCM) and two climate-forcing scenarios.

The results of the FEMA study show that the projected 1-percent-annual-chance peak flow (Q100) discharge estimates for 2060 increased across a majority of the country. The Northeast and Great Lakes regions had the largest Q100 increases with widespread changes of 75 to 100 percent (100 percent implies a doubling over present values). Nationwide, the average observed historical value of Q100 was calculated to be 23,943 cubic feet per second (cfs), compared to average projected 2060 value of 27,166 (+13 percent) cfs for the Representative Concentration Pathway (RCP) 2.6 scenario and 32,537 (+36 percent) cfs for the RCP 8.5 scenario. (Internal FEMA report, 2015)

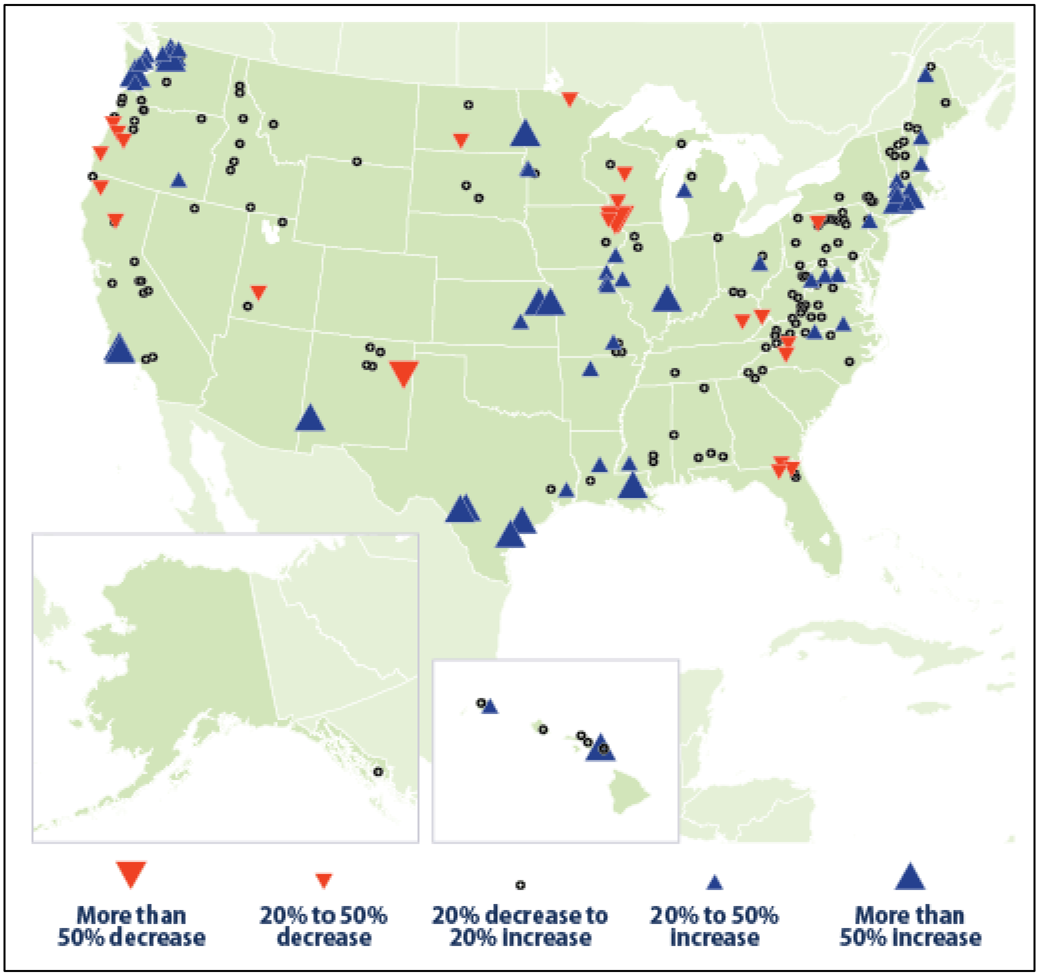
Figure 3-50 shows the percentage changes in the minimum streamflow (amount of water carried) of rivers and streams across the country based on the long-term rate of change from 1940-2009. Minimum streamflow is based on the 7-day period with the lowest average during a given year. The Pacific Northwest region has seen a 20 to 50 percent decrease in the minimum amount of streamflow in some areas, while many areas in the Midwest and Northeast have seen a more than 50 percent increase in the minimum streamflow. (EPA, 2012q)

Figure 3-51 shows the percentage changes in the maximum streamflow (amount of water carried) of rivers and streams across the country based on the long-term rate of change from 1940 to 2009. Maximum streamflow is based on the 3-day period with highest average flow during a given year. In some areas, such as southeastern Louisiana, there has been a more than 50 percent increase in maximum streamflow (EPA, 2012q). A FEMA study projected that an expected increase in the United States riverine and coastal flooding together will amount to an average increase of the SFHA by 40 to 45 percent by the year 2100 (AECOM, 2013).



Source: (EPA, 2012q)

Figure 3-50: Volume of Seven Days Low Streamflows, 1940 – 2009



Source: (EPA, 2012q)

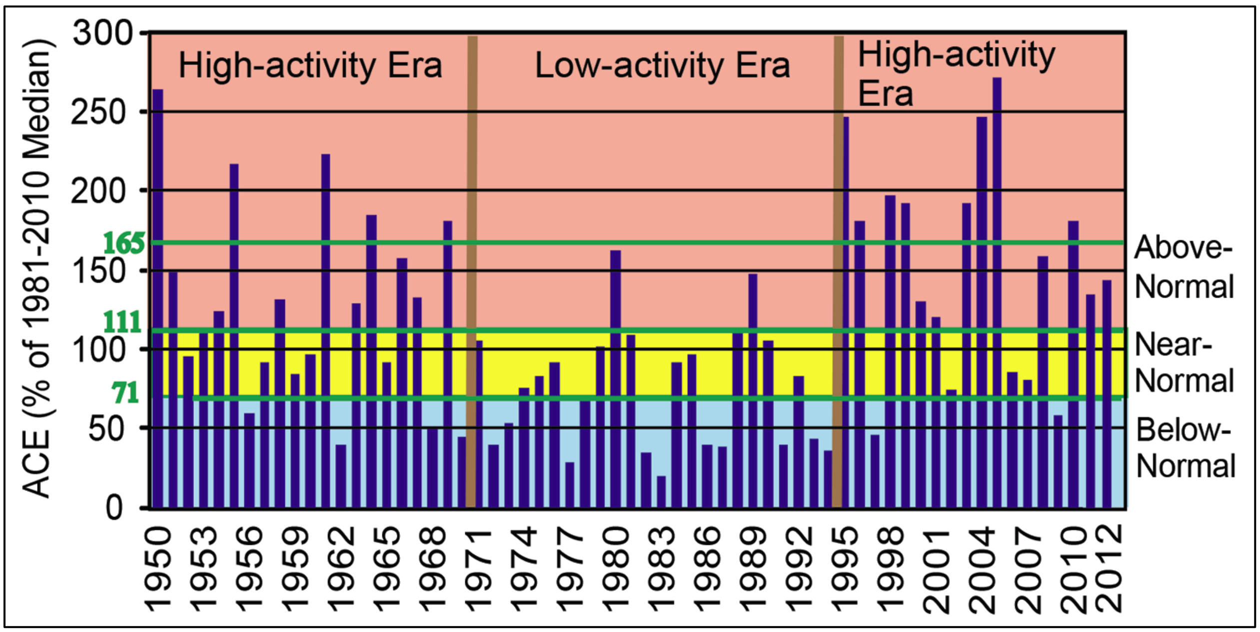
Figure 3-51: Volume of Three Days High Streamflows, 1940 – 2009

3.13.3.5 Extreme Events: Tropical Storms, Tropical Cyclones and Hurricanes

The frequency of high-severity Atlantic hurricanes is increasing, resulting in more frequent and severe storm surge events and wave heights (Kishtawal, Jaiswal, Singh, & Niyogi, 2012). There were 84 named tropical storms in 2012, slightly below the 1981–2010 average of 89 storms. However, the 2012 total was higher than the previous two seasons, with 2010 having the lowest number of global named storms since the start of the satellite era. The only basin with above normal activity in 2012 was the North Atlantic. The 2012 Atlantic hurricane season produced 19 tropical storms, of which 10 became hurricanes, and 2 became major hurricanes. The 30-year seasonal averages for the North Atlantic are 11.8 tropical storms, 6.4 hurricanes, and 2.7 major hurricanes respectively (Blunden & Arndt, 2013). A recent study examined the combination of storm surge and heavy precipitation and found that the number of these types of compounded events has increased over the past century at many major coastal cities (Wahl, Jain, Bender, Meyers, & Luther, 2015).

NOAA's seasonal accumulated cyclone energy (ACE) index "is a wind energy index, defined as the sum of the squares of the maximum sustained surface wind speed (knots) measured every six hours for all named storms while they are at least tropical storm strength" (NOAA, 2015f). NOAA uses the ACE index, combined with the seasonal total number of named storms, hurricanes, and major hurricanes to categorize North Atlantic hurricane seasons as being above normal, near normal, or below normal. The ACE index for the 2012 North Atlantic season corresponds to 144 percent of the 1981-2010 median, as shown in Figure 3-52. This value is the 19th highest since 1950, and the 11th highest in the last 30 years. This level of activity, combined with above-average numbers of named storms and hurricanes, satisfies NOAA's criteria for an above-normal season. The 1981-2010 seasonal averages are 12 named storms, 6 hurricanes, and 3 major hurricanes.

Between 1950 and 1970, 11 seasons are classified as above normal, with five being hyperactive. Four seasons are classified as below normal in this era. The 1995-2012 period saw even higher activity than the period between 1950 and 1970. For 1995-2012, 13 seasons are classified as above normal with 8 being hyperactive, compared to only five between 1950 and1970. Only two seasons are classified as below normal for 1995 to 2012. Between the high activity periods of 1950-1970 and 1995-2012 is the low activity period from 1971 to 1994; during these years, 11 seasons were below normal and only 3 were above normal. (Blunden & Arndt, 2013)



Source: (Blunden & Arndt, 2013)

Figure 3-52: ACE Index for Low, Normal, and High Tropical Storm Activity, 1950 – 2012

3.13.4 Existing Conditions—NCDC Regions

To provide detailed information regarding the Affected Environment, a brief discussion of trends will be discussed on a regional basis. The NOAA NCDC climate regions are used for this analysis (see Figure 3-5).

3.13.4.1 Northeast Climate Region

The Northeast climate region consists of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Pennsylvania, Maryland, and DC. There is considerable variation throughout the region; the northern and western portions are characterized by harsh, cold winters and milder summers whereas towards the southern portion, winters are milder and summers warmer. States bordering the Great Lakes to the south and east are subject to "lake effect" snow, contributing to the substantial snowfall in the region. The region is susceptible to sea level rise from the Atlantic Ocean. Data on the effects of climate change on the Great Lakes are not yet conclusive, although a drop in lake levels is possible. (Goodrich, 2009)

3.13.4.1.1 Climate Characteristics and Trends

Over the past 100 years, this region has seen substantial increases in average temperatures (up to 3° F). The most significant changes were observed in the northern portion of the region with changes as low as 1° F in the western area (EPA, 2015j). Rhode Island warmed at the fastest rate in the United States, with an average increase of 0.339° F per decade; Massachusetts, New Jersey, and Maine were also in the top five States for average temperature increases (Tebaldi, Adams-Smith, & Heller, 2012). Depending on emissions of heat-trapping gases, temperatures could rise 3° F to 6° F if emissions were reduced substantially or 4.5° F to 10° F if emissions continue to increase (Melillo, Richmond, & Yohe, 2014).

The region is expected to see a substantial increase in very heavy precipitation events, and has already seen increases in observed rainfall of 20 percent or more (EPA, 2015j) (U.S. Global Change Research Program, 2009). This area has historically been susceptible to nor'easters, which are macro-scale storms that can cause coastal flooding and erosion, hurricane-force winds, or blizzard conditions (Weather.com, 2012).

3.13.4.2 Southeast Climate Region

The Southeast climate region consists of Virginia, North Carolina, South Carolina, Georgia, Florida, and Alabama. The region is characterized by mild winters and hot, humid summers. The region is susceptible to sea level rise from the Atlantic Ocean and Gulf of Mexico.

3.13.4.2.1 Climate Characteristics and Trends

The rate of temperature change in this region has been slow, with some areas seeing no change in temperature or even a decline (Tebaldi, Adams-Smith, & Heller, 2012). One notable exception is Florida with observed temperature increases as high as 3° F (EPA, 2015j). Average tempature increases are in the range of 4° F to 8° F (Melillo, Richmond, & Yohe, 2014). The region is expected to see a moderate increase in very heavy precipitation events. Increases in precipitation of up to 20 percent have already been observed in the region (U.S. Global Change Research Program, 2009). The area is susceptible to severe storm events, such as hurricanes and tornadoes, with Florida averaging 66 tornadoes annually from 1991 through 2010 (NCDC, 2013).

3.13.4.3 East North Central Climate Region

The East North Central climate region includes Michigan, Wisconsin, Iowa, and Minnesota. The region is characterized by very cold, harsh winters and short, mild summers. The region is susceptible to flooding due to changes in lake levels, as it borders Lakes Erie, Huron, Michigan, and Superior, and to flooding of the Mississippi River.

3.13.4.3.1 Climate Characteristics and Trends

Average temperatures in the region have gone up significantly, by almost 4° F in the northernmost areas. This increase is evident by a decline in Great Lakes ice cover in winter (Niziol, 2013). Future increases range from 5.6° F to 8.5° F (Melillo, Richmond, & Yohe, 2014). The region is expected to receive a substantial increase in very heavy precipitation events, and has already seen an increase in observed precipitation of up to 30 percent (EPA, 2015j) (U.S. Global Change Research Program, 2009). The northern parts of this region are also susceptible to lake effect snow with an average winter snowfall in the upper peninsula of Michigan of more than 200 inches (Michigan Tech Alumni Association, Undated).

3.13.4.4 Central Climate Region

The Central climate region contains West Virginia, Ohio, Indiana, Illinois, Missouri, Kentucky, and Tennessee. There is some variation throughout the region, with the northern portion subject to colder, harsh winters and the southern portion characterized by warmer summers and milder winters. Northern Ohio, Indiana, and Illinois all border the Great Lakes and are susceptible to lake effect snow and vulnerable to changes in lake levels. Furthermore, the region is subject to flooding from the Mississippi River.

3.13.4.4.1 Climate Characteristics and Trends

The region has seen moderate increases in temperatures, up to 1.5° F in the northern part of the region. Moderate increases in precipitation are expected. West Virginia, Missouri, Kentucky, and Tennessee are among the slowest warming States in the country. (Tebaldi, Adams-Smith, & Heller, 2012)

3.13.4.5 South Climate Region

The South climate region contains Mississippi, Louisiana, Arkansas, Oklahoma, Texas, and Kansas. There is considerable variation throughout the region, as the southern portion is characterized by hot, humid summers and short, mild winters with temperatures decreasing toward the northern portion of the region. The region is susceptible to sea level rise along the Gulf of Mexico and flooding along the Mississippi River.

3.13.4.5.1 Climate Characteristics and Trends

The region has seen mild to moderate increases in temperature, with Mississippi, Louisiana, and Arkansas observed to be among the slowest warming States (EPA, 2015j) (Tebaldi, Adams-Smith, & Heller, 2012). The area is expected to see relatively minor increases in very heavy precipitation events, and has already seen increases in precipitation of up to 20 percent in some places. The area is at the center of "Tornado Alley," with Texas experiencing an average of 155 tornadoes per year and Kansas experiencing 96 (NCDC, 2013). The southern portion is also vulnerable to hurricanes and has experienced several major storms in recent years, including Hurricanes Katrina, Rita, and Ike.

3.13.4.6 West North Central Climate Region

The West North Central climate region contains North Dakota, South Dakota, Nebraska, Montana, and Wyoming. The region is characterized by extremely cold harsh winters and mild short summers. Although the States are land-locked, they are still vulnerable to riverine flooding from the Missouri River and its tributaries.

3.13.4.6.1 Climate Characteristics and Trends

The region has seen significant increases in temperature (up to 4° F) and higher temperatures are anticipated to occur more frequently (EPA, 2015j) (U.S. Global Change Research Program, 2009) (Melillo, Richmond, & Yohe, 2014). Moderate increases in very heavy precipitation events are expected; the region has already seen increases in precipitation of up to 20 percent in the northern areas. (EPA, 2015j) (U.S. Global Change Research Program, 2009)

3.13.4.7 Southwest Climate Region

The Southwest climate region contains Colorado, New Mexico, Arizona, and Utah. There is considerable variation within this region, which features deserts characterized by extremely hot summers and negligible annual precipitation, and the Rocky Mountains, characterized by cold winters and significant annual snowfall. This region is also landlocked, but subject to riverine flooding.

3.13.4.7.1 Climate Characteristics and Trends

The region has seen temperatures rise from 1.5° to 4° F in the past century. Arizona, Colorado, and Utah are among the fastest warming States in the country (Tebaldi, Adams-Smith, & Heller, 2012). Annual average temperatures are anticipated to increase by 5.5° F to 9.5° F if emissions continue at current trends and 3.5° F to 5.5° F if emissions are reduced substantially (Melillo, Richmond, & Yohe, 2014). Minor increases in precipitation are expected in the region, and, precipitation has declined in the region, with the exception of part of eastern Utah.

3.13.4.8 Northwest Climate Region

The Northwest climate region consists of Idaho, Washington, and Oregon. The western part of the region is characterized by mild temperatures year-round with heavy precipitation. The entire region is greatly influenced by weather patterns coming off the Pacific Ocean and is vulnerable to sea level rise.

3.13.4.8.1 Climate Characteristics and Trends

This region has seen temperature increases of 1° to 2° F with temperatures projected to increase 3.3° F to 9.7° F with the largest increases during summer months (Bedient & Huber, 2002) (Melillo, Richmond, & Yohe, 2014). Moderate increases in very heavy precipitation events are expected, and the region has already seen mild to moderate increases in precipitation. The climate is already heavily influenced by orographic lift in the western portion, where warm, humid air from the Pacific Ocean is forced upward by coastal mountains where it cools and condenses. This results in heavy rainfall on the western side of the mountains, and very dry conditions on the eastern side. (Bedient & Huber, 2002)

3.13.4.9 West Climate Region

The West climate region contains California and Nevada. Overall, precipitation is low in the eastern portion of this region. High temperatures and desert conditions are present in most of Nevada. California has a more diverse climate with cooler temperatures and higher precipitation in the northern coastal part of the State, and hot, dry conditions in the southern part of the State. The region is susceptible to sea level rise from the Pacific Ocean.

3.13.4.9.1 Climate Characteristics and Trends

The region has seen overall increases in temperature; in particular, the southern portion of the region has seen significant increases up to 4° F (EPA, 2015j). The Sierra Nevada Mountains and Coastal Mountains form a significant natural feature that creates orographic lift and impacts rainfall in Nevada and the Central Valley of California (Bedient & Huber, 2002).

REFERENCES

Advisory Council on Historic Preservation. (2016, October 11). *INFORMATION PAPER ON CULTURAL LANDSCAPES: Undertanding and Interpreting Indigenous Places and Landscapes.* Retrieved from Advisory Council on Historic Preservation: http://www.achp.gov/docs/Information%20on%20Cultural%20Landscapes.pdf

AECOM. (2013). *The Impact of Climate Change and Population Growth on the NFIP Through 2012.* Retrieved December 2013, from http://www.aecom.com/deployedfiles/Internet/News/Sustainability/FEMA%20Climate%20Change%20Report/Climate_Change_Report_AECOM_2013-06-11.pdf

Alaska Department of Environmental Conservation. (2012). *Alaska's DRAFT 2012 Integrated Water Quality Monitoring and Assessment Report.* Retrieved December 2013, from http://dec.alaska.gov/water/wqsar/waterbody/docs/2012finalIntegratedReport.pdf

Alaska Department of Fish and Game. (2001). *Tundra Topography and Soil.* Retrieved December 15, 2015, from http://www.adfg.alaska.gov/static-sf/statewide/aquatic_ed/AWC%20ACTIVITIES/TUNDRA%20&%20WILDLIFE/BACKGROUND%20INFORMATION/Tundra%20II_Topography%20and%20Soil%20Facts.pdf

Alaska Department of Fish and Game. (2015). *Land Mammal Viewing*. Retrieved December 18, 2015, from http://www.adfg.alaska.gov/index.cfm?adfg=viewing.landmammals

Alaska Department of Natural Resources. (2013). *Surface Water*. Retrieved September 2013, from http://dnr.alaska.gov/mlw/water/hydro/components/surface-water.cfm

Alaska Public Lands Information Centers. (2016). *Maps of Northern Alaska*. Retrieved from http://www.alaskacenters.gov/index.cfm

Alaska Rangelands. (undated). *Barren Tundra*. Retrieved December 18, 2015, from Barren Tundra: http://globalrangelands.org/alaska/barren-tundra

Albert, D. (2010a, June). *Natural Community Abstract for Sand and Gravel Beach.* Retrieved December 30, 2015, from http://mnfi.anr.msu.edu/abstracts/ecology/Sand_and_gravel_beach.pdf

Albert, D. (2010b, June). *Natural Communities Abstract for Open Dunes.* Retrieved December 30, 2015, from http://mnfi.anr.msu.edu/abstracts/ecology/Open_dunes.pdf

Alexander, I. R., & Geluso, K. (2013). Bats of Vieques National Wildlife Refuge, Puerto Rico, Greater Antilles. *Check List Journal of Species Lists and Distribution*, 294-297. Retrieved December 17, 2015, from http://www.checklist.org.br/getpdf?SL085-12

American Association of Port Authorities. (2013). *U.S. Public Port Facts*. Retrieved September 2013, from http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=1032

American Geophysical Union. (2006). *Coastal Louisiana in Crisis: Subsidence or Sea Level Rise*. Retrieved September 2013, from http://www.tulane.edu/~tor/documents/Eos2006.pdf

American Hospital Association. (2013). *Fast Facts on U.S. Hospitals*. Retrieved October 2013, from http://www.aha.org/research/rc/stat-studies/fast-facts.shtml

American Society of Civil Engineers. (2013). *2013 Report Card for America's Infrastructure.* Retrieved from http://www.infrastructurereportcard.org/a/browser-options/downloads/2013-Report-Card.pdf

American Wind Energy Association. (2012). *U.S. Wind Industry Annual Market Report*. Retrieved February 2014, from http://awea.files.cms-plus.com/images/AWEA_USWindIndustryAnnualMarketReport2012_ExecutiveSummary(2).pdf

America's State Parks. (2014). *About America's State Parks*. Retrieved February 2014, from http://www.americasstateparks.org/About

Amtrak. (2011). *Amtrak's Northeast Corridor- Facts and Background Information*. Retrieved November 2013, from http://www.amtrak.com/ccurl/193/174/Amtrak-Northeast-Corridor-2011.pdf

Amtrak. (2013). *Amtrak National Facts*. Retrieved September 2013, from http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1246041980246

Anderson, D. G. (1990). *Paleoindian Period Archaeology of Georgia.* Athens, GA: University of Georgia. Retrieved February 2017

Anderson, J. R., Hardy, E. E., Roach, J. T., & Witmer, R. (1976). *A Land Use and Land Cover Classification System for Use With Remote Sensor Data.* U.S. Department of the Interior, Geological Survey. Washington, DC: United States Government Printing Office.

Apitz, S. (2012). *Ecosystem Services and Environmental Decision Making: Seeking Order in Complexity.* Retrieved October 2013, from http://www.academia.edu/2652655/Ecosystem_Services_and_Environmental_Decision_Making_Seeking_Order_in_Complexity

Arizona Geological Survey. (Undated). *Arizona's Geologic Hazard Center: Floods and Debris Flows*. Retrieved October 2013, from http://www.azgs.az.gov/hazards_floods.shtml

Arkansas Geological Survey. (2015a). *Landslides - Case Studies*. Retrieved October 2015, from http://www.geology.ar.gov/geohazards/landslides_casestudies.htm

Arkansas Geological Survey. (2015b). *Landslides in Arkansas*. Retrieved October 2015, from http://www.geology.ar.gov/geohazards/landslides.htm

Asian Institute of Technology. (Undated). *ED78.20 Industrial Waste Abatement and Management - Seafood Processing*. Retrieved December 2013, from http://www.fpeac.org/seafood/IndustrialWasteAbatement-Seafood.pdf

Asia-Pacific Migratory Waterbird Conservation Committee. (2001). *Asia-Pacific Migratory Waterbird Conservation Strategy: 2001-2005.* Retrieved from http://155.187.2.69/biodiversity/migratory/publications/asia-pacific/pubs/strategy.pdf

Associated Press. (2012). *Hurricane Irene Facts: A Region-By-Region Look At The Storm's Toll.* Retrieved February 2014, from http://www.huffingtonpost.com/2012/08/27/hurricane-irene-damage-statistics-2011_n_1832342.html

Association of American Railroads. (2013). *Class I Railroad Statistics.* Retrieved September 2013, from https://www.aar.org/StatisticsAndPublications/Documents/AAR-Stats-2013-02-07.pdf

Association of State Dam Safety Officials. (2013). *Dam Safety 101*. Retrieved September 2013, from Association of State Dam Safety Officials: http://www.damsafety.org/news/?p=e4cda171-b510-4a91-aa30-067140346bb2

Association of State Floodplain Managers. (2008, September 16). *Natural and Beneficial Floodplain Functions: Floodplain Management - More than Flood Loss Reduction.* Retrieved July 27, 2016, from https://www.floods.org/PDF/WhitePaper/ASFPM_NBF%20White_Paper_%200908.pdf

Audubon Alaska. (2016). *Tongass National Forest*. Retrieved from http://ak.audubon.org/tongass-national-forest-0

Audubon Society. (2011). *Flyaway Conservation.* Retrieved January 12, 2016, from http://www.audubon.org/sites/default/files/documents/ar2011-flywayconservation.pdf

Ayotte, J., & Robinson, K. (1997). *National water quality assessment program: New England Coastal Basins: U.S. Geological Survey Fact Sheet FS-060-97.* Retrieved February 2014, from http://pubs.usgs.gov/fs/fs-060-97/

Bartolino, J. R., & Cole, J. C. (2002). *Ground-water Resources of the Middle Rio Grande Basin, Water Resources Circular 1222.* U.S. Geological Survey. Retrieved December 2013, from http://pubs.usgs.gov/circ/2002/circ1222/pdf/chap9.pdf

Bedient, P., & Huber, W. (2002). *Streamflow Evaluations for Watershed Restoration Planning and Design -- Terminology*. Retrieved October 2013, from http://streamflow.engr.oregonstate.edu/terminology/index.htm

Bell, J., Price, J., & Mifflin, M. (1992). *Las Vegas Valley: Land Subsidence and Fissuring Due to Ground-Water Withdrawal.* Retrieved April 2015, from http://geochange.er.usgs.gov/sw/impacts/hydrology/vegas_gw/

Bennett, D. (2008). Do natural disasters stimulate economic growth? *The New York Times*. Retrieved December 2013, from http://www.nytimes.com/2008/07/08/business/worldbusiness/08iht-disasters.4.14335899.html?pagewanted=all&_r=2&

Benson, C., & Clay, E. J. (2004). *Understanding the Economic and Financial Impacts of Natural Disasters.* Retrieved December 2013, from http://wwwwds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/04/20/000012009_20040420135752/Rendered/PDF/284060PAPER0Disaster0Risk0no.04.pdf

Berglund, Birgitta, & Lindvall. (1995). *Community Noise.* Retrieved December 2013, from http://www.nonoise.org/library/whonoise/whonoise.htm

Blake, E. S., Landsea, C. W., & Gibney, E. J. (2011). *The Deadliest, Costliest, and Most Intense United State Tropical Cyclones from 1851 to 2010 (And Other Frequently Requested Hurricane Facts).* Retrieved February 2014, from http://www.nhc.noaa.gov/pdf/nws-nhc-6.pdf

Blake, E., Kimberlain, T. B., Berg, R. J., Cangialosi II, J. P., & Beven, J. L. (2013). *Tropical Cyclone Report: Hurricane Sandy.* Retrieved December 2013, from http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf

BLM. (2005a). *BLM-M-8410-1 Visual Resource Inventory*. Retrieved October 2013, from http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.31679.File.dat/H-8410.pdf

BLM. (2005b). *Hazardous Materials and Wastes*. Retrieved December 2013, from http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/energy/coal/prb/coalreview/task1d.Par.9468.File.dat/sec2-10.pdf

BLM. (2010). *BLM-M-8400 Visual Resource Management*. Retrieved October 2013, from http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.34032.File.dat/8400.pdf

BLM. (2013). *Bureau of Land Management - Nevada*. Retrieved September 2013, from http://www.blm.gov/nv/st/en.html

Bluedaze Drilling Reform. (2013). *Is there a media blackout on the fracking flood disaster in Colorado?* Retrieved December 2013, from http://www.texassharon.com/2013/09/15/is-there-a-media-blackout-on-the-fracking-flood-disaster-in-colorado/

Blunden, J., & Arndt, D. S. (Eds.). (2013). *2013: State of the Climate in 2012.* Retrieved October 2013, from http://dx.doi.org/10.1175/2013BAMSStateoftheClimate.1

Bouwer, H. (Undated). *Our Underground Water Supplies: the Sometimes Dry Facts*. Retrieved September 2013, from http://naldc.nal.usda.gov/download/IND84105140/PDF

Braham, H. (1984, 46(4)). The Status of Endangered Whales: An Overview. *Marine Fisheries Review*, pp. 2-6. Retrieved from http://spo.nmfs.noaa.gov/mfr464/mfr4642.pdf

Breitburg, E.J. (1996). *The Coats-Hinds Site: Tennessee's First Paleoindian-Mastadon Association.*

Brennan, M. (2011). *2010's Worst Cities for Foreclosure*. Retrieved October 2013, from http://www.forbes.com/sites/morganbrennan/2011/01/26/the-worst-cities-for-foreclosures-in-2010/

Bricker, S., Rice, K., & Bricker, O. (2014). *From headwaters to coast: influence of human activities on water quality of the Potomac River Estuary.* Retrieved from http://www2.coastalscience.noaa.gov/publications/handler.aspx?resource=tGjmvcmzkuSIKKrh8f0JM72ls1dpfuVHIgAv6xKolJI=

Bunch, J. (2013). *Colorado Floods Washout Tracks, Delay Coal Shipments, Amtrak Service*. Retrieved December 2013, from http://www.denverpost.com/breakingnews/ci_24106977/colorado-floods-wash-out-tracks-delay-train-service

Bureau of Economic Analysis. (2016a). *SA1 Personal Income Summary: Personal Income, Population, Per Capita Personal Income; February 2016.* Retrieved from http://bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=6#reqid=70&step=30&isuri=1&7022=21&7023=0&7033=-1&7024=non-industry&7025=0&7026=00000&7027=2014,2010,2000&7001=421&7028=-1&7031=0&7040=-1&7083=levels&7029=21&7090=70

Bureau of Economic Analysis. (2016b). SA25N Total Full-Time and Part-Time Employment by NAICS Industry. Retrieved February 2016, from http://www.bea.gov/regional/index.htm

Bureau of Justice Statistics. (2008). *Census of State and Local Law Enforcement Agencies, 2008.* Retrieved October 2013, from www.bjs.gov/content/pub/pdf/csllea08.pdf

Bureau of Labor Statistics. (2016, February). *Employment status of the civilian noninstitutional population, 1976 to 2014 annual averages.* Retrieved from http://www.bls.gov/lau/staadata.txt

Bureau of Natural Heritage Conservation. (2014, May). *Draft Rapid Resource Inventory & Assessment of Horseshoe Bay Cave.* Retrieved December 30, 2015, from http://map.co.door.wi.us/Agendas-Minutes/Airport%20&%20Parks/2014/2014-05-20%20meeting%20info%20-%20Scientific%20Inventory%20&%20Assessment%20of%20Horseshoe%20Bay%20Cave.pdf

Bureau of Ocean Energy Management. (2015, September). *Cape Wind Energy Project Fact Sheet*. Retrieved from http://www.boem.gov/Cape-Wind-Fact-Sheet/

Bureau of Reclamation. (1990). *Colorado River Basin Probable Maximum Floods Hooverand Glen Canyon Dams*. Retrieved October 2013, from http://www.riversimulator.org/Resources/USBR/MaxProbableFloods.pdf

Bureau of Reclamation. (2009). *Red Willow Dam Investigations*. Retrieved October 2015, from http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=30861

California Coastal Commission. (2011). *FINAL 2010 Updated Assessment and Strategy for the California Coastal Management Program (CCMP).* Retrieved October 2013, from http://coastalmanagement.noaa.gov/mystate/docs/ccc3092011.pdf

California Department of Water Resources. (1984). *Land Subsidence in the San Joaquin Valley, California, as of 1980*. Retrieved September 2013, from http://www.calwater.ca.gov/Admin_Record/C-040893.pdf

California Department of Water Resources. (2010). *CA State Water Project Overview*. Retrieved September 2013, from http://www.water.ca.gov/swp/index.cfm

California Department of Water Resources. (2013). *California Water Plan Update 2013, Investing in Innovation and Infrastructure, Volume 1--The Strategic Plan.* Retrieved October 2013, from http://www.waterplan.water.ca.gov/docs/cwpu2013/2013-prd/

California Emergency Management Agency. (2013). *State Hazard Mitigation Plan*. Retrieved December 2015, from http://hazardmitigation.calema.ca.gov/docs/SHMP_Final_2013.pdf

California Manufacturing Technology Consulting. (2013). *Made in California*. Retrieved 2013 December, from http://www.cmtc.com/made-in-california-program/

California Natural Resources Agency. (2013). *California's Flood Future Attachment C: History of California Flooding*. Retrieved October 2013, from http://www.water.ca.gov/sfmp/resources/PRD_AttachC_History_4-3-13.pdf

California Sea Grant. (2009). *Septic Tanks Affect Coastal Water Quality*. Retrieved September 2013, from http://www-csgc.ucsd.edu/NEWSROOM/NEWSRELEASES/2009/CoastalWaterQuality.html

California Sea Grant. (2015a). *Wrack Community*. Retrieved December 31, 2015, from Sea Grant California: https://caseagrant.ucsd.edu/project/explore-sandy-beach-ecosystems-of-southern-california/sandy-beach-plants-and-animals/wrack

California Sea Grant. (2015b). *Marine Mammals.* Retrieved December 31, 2015, from Sea Grant California: https://caseagrant.ucsd.edu/project/explore-sandy-beach-ecosystems-of-southern-california/sandy-beach-plants-and-animals/marine

California Sea Grant. (2015c). *Plants.* Retrieved December 31, 2015, from Sea Grant California: https://caseagrant.ucsd.edu/project/explore-sandy-beach-ecosystems-of-southern-california/sandy-beach-plants-and-animals/plants

Campbell, B., & Coes, A. (2010). *Groundwater availability in the Atlantic Coastal Plain of North and South Carolina.* Retrieved December 2013, from http://pubs.usgs.gov/pp/1773/pdf/pp1773.pdf

Carbone, V. (1976). *Environment and Prehistory in the Shenandoah Valley*.

Carstensen, R. (2007b, March). Coastal Habitats of Southeast Alaska. In J. W. Schoen, & E. Dovichin (Eds.), *The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis.* Retrieved January 4, 2016, from https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/seak/era/cfm/Documents/5.3_Coastal_habitats.pdf

Carstensen, R. (2007c, March). Terrestrial Habitats of Southeast Alaska. In J. W. Schoen, & E. Dovichin (Eds.), *The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis.* Retrieved January 4, 2016, from The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass

National Forest: A Conservation Assessment and Resource Synthesis: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/seak/era/cfm/Documents/5.2_Terrestrial.pdf

Carstensen, Richard. (2007a, March). *Freshwater Aquatic Habitats of Southeast Alaska.* (J. W. Schoen, & E. Dovichin, Eds.) Retrieved January 4, 2016, from The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/seak/era/cfm/Documents/5.4_Freshwater.pdf

Casco Bay Estuary Partnership. (Undated). *Septic Systems - How they Work and How to Keep them Working*. Retrieved September 2013, from http://www.maine.gov/dep/water/groundwater/septic_systems.pdf

CBS New York. (2013). *LaGuardia Airport to get $37M in Anti-Flood Aid*. Retrieved December 2013, from http://newyork.cbslocal.com/2013/11/17/laguardia-airport-to-get-37m-in-anti-flood-aid/

Center for Watershed Protection. (2014). *Climate Change & Stormwater Management: Capacity for Community Adaptation Planning*. Retrieved March 2014, from http://www.cwp.org/2013-04-07-22-15-38/entry/climate-change-stormwater-management-capacity-for-community-adaptation-planning

CEQ. (1997a). *Environmental Justice: Guidance Under the National Environmental Policy Act.* Retrieved December 2013, from http://www.epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf

Chandler, A., & Doerr, E. (2008). *Richland Creek Road Landslide.* Retrieved October 2015, from http://www.geology.ar.gov/pdf/Richland%20Creek%20Road%20landslide.pdf

Chesapeake Bay Foundation. (2012). *Habitats of the Chesapeake*. Retrieved October 2013, from http://www.cbf.org/about-the-bay/more-than-just-the-bay/habitats-of-the-chesapeake

Cincinnati.com. (2012). *Columbia Parkway Landslides Costly*. Retrieved September 2013, from http://news.cincinnati.com/article/20111231/NEWS/312310033/Columbia-Parkway-landslides-costly

Climate Central. (2013). *U.S. Airports Face Increasing Threat From Rising Seas*. Retrieved September 2013, from http://www.climatecentral.org/news/coastal-us-airports-face-increasing-threat-from-sea-level-rise-16126

Cobb, C. R. (2012, September). *The Oxford Handbook of Archaeology*. Retrieved February 13, 2017, from Oxford Handbooks Online: http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199271016.001.0001/oxfordhb-9780199271016-e-30

Coffman, K. (2013). *Property Losses from Colorado Flood Projected at About $2 Billion*. Retrieved February 2014, from Reuters.com: http://www.reuters.com/article/2013/09/19/us-usa-colorado-flooding-idUSBRE98H1BA20130919

Cohen, J. (2010, June). *Natural Community Abstract for Oak Barrens.* Retrieved December 30, 2015, from http://mnfi.anr.msu.edu/abstracts/ecology/Oak_barrens.pdf

Colorado Deparment of Natural Resources. (2015). *Colorado 2015 State Wildlife Action Plan*. Retrieved from Chapter 4: Threats and Conservation Actions Overview: http://cpw.state.co.us/Documents/WildlifeSpecies/SWAP/CO_SWAP_Chapter4.pdf

Colorado Mining Association. (2007). *Coal & Mineral Production*. Retrieved December 2013, from http://www.coloradomining.org/mc_mineralproduction.php

Commission for Environmental Cooperation. (1997). *Ecological Regions of North America, Toward a Common Perspective.* Retrieved September 30, 2013, from ftp://ftp.epa.gov/wed/ecoregions/cec_na/CEC_NAeco.pdf

Committee on Missouri River Ecosystem Science. (2002). *The Missouri River Ecosystem: Exploring the Prospects for Recovery*. Retrieved September 2013, from http://www.nap.edu/openbook.php?record_id=10277&page=R1

Convention on Biological Diversity. (2013). *Article 2. Use of Terms*. Retrieved October 2013, from http://www.cbd.int/convention/articles/default.shtml?a=cbd-02

Cornell Lab of Ornithology. (2016, January 25). *The Basics of Bird Migration: How, Why, and Where*. Retrieved from All About Birds: https://www.allaboutbirds.org/the-basics-how-why-and-where-of-bird-migration/

Costa, J., & Schuster, R. (1987). *The Formation and Failure of Natural Dams.* U.S. Geological Survey. Retrieved August 2014, from http://pubs.usgs.gov/of/1987/0392/report.pdf

County of Hawaii. (2005). *County of Hawaii General Plan*. Retrieved September 2013, from http://www.cohplanningdept.com/wp-content/uploads/2013/01/GP2005AmendthruOrd12-089.pdf

Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. (1979). *Classification of wetlands and deepwater habitats of the United States, FWS/OBS-79/31.* Retrieved December 2013, from http://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf

Crain, P., Whitener, K., & and Moyle, P. (2004). *Use of a Restored Central California Floodplain by Larvae of Native and Alien Fishes.* Retrieved September 2013, from http://wfcb.ucdavis.edu/www/Faculty/peter/petermoyle/publications/LarvaeFishUse.pdf

CSX. (2012). *CSX Coal News (Vol. 2, No.3).* Retrieved September 2013, from http://www.csx.com/share/wwwcsx_mura/assets/File/Customers/Commodities/Coal/CoalNews_Dec2012_2.pdf

Dahl, K. A., Fitzpatrick, M. F., & Spanger-Siegfried, E. (2017). *Sea level rise drives increased tidal flooding frequency at tidal gauges along the U.S. East and Gulf Coasts: Projections for 2030 and 2045.* Retrieved from http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0170949&type=printable

Dahl, T. (2011). *Status and trends of wetlands in the conterminous United States 2004 to 2009.* Retrieved October 2013, from http://www.fws.gov/Wetlands/Documents/Status-and-Trends-of-Wetlands-in-the-Conterminous-United-States-2004-to-2009.pdf

Dahl, T. (2014). *Status and Trends of Prairie Wetlands in the United States 1997 to 2009.* Retrieved January 3, 2016, from http://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Prairie-Wetlands-in-the-United-States-1997-to-2009.pdf

Dasher, D., & Lomax, T. (2011, May). *Alaska Department of Enviromental Conservation 2004 Southeast Alaska Coastal Survey Environmental Status.* Retrieved January 13, 2016, from http://dec.alaska.gov/water/wqsar/pdfs/Reports/Southeast-Coastal-Survey-2004-ADEC.pdf

Debrewer, L., Ator, S., & Denver, J. (2008). *Temporal Trends in Nitrate and Selected Pesticides in Mid-Atlantic Ground Water.* Retrieved October 2013, from https://www.agronomy.org/publications/jeq/abstracts/37/5_Supplement/S-296

Department of the Interior. (1997). *Lake Roosevelt National Recreation Area, Washington – Water Resources Scoping Report*. Retrieved September 2013, from http://www.nature.nps.gov/water/planning/scoping_reports/lake_Roosevelt_press.pdf

Department of the Interior. (2008). *Navajo Reservoir RMP/FEA Appendix E Noise*. Retrieved 07 22, 2015, from https://www.usbr.gov/uc/envdocs/ea/navajo/appdx-E.pdf

Department of the Interior. (Undated). *Part 622 – Interpretive Groups*. Retrieved September 2013, from http://soils.usda.gov/technical/handbook/contents/part622.html

Department of the Interior, Indian Affairs. (2016, June 10). *What We Do.* Retrieved September 2013, from http://www.bia.gov/WhatWeDo/index.htm

Department of Transportation. (2015, May 28). *Highway Traffic Noise*. Retrieved 07 22, 2015, from http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm

Deryugina, T. (2013). *The Role of Transfer Payments in Mitigating Shocks: Evidence From the Impact of Hurricanes.* Retrieved February 2014, from http://deryugina.com/2013_08_08DeryuginaSafetyNet.pdf

DeSenne, M. (2013). *Most Expensive U.S. Cities to Live In.* Retrieved October 2013, from http://www.kiplinger.com/printslideshow.php?pid=10202

Ducks Unlimited. (2016). *Waterfowl Migration Flyways*. Retrieved from Ducks Unlimited: http://www.ducks.org/conservation/where-we-work/flyways

Edison Electric Institute. (2013). *Transmission*. Retrieved September 2013, from http://www.eei.org/issuesandpolicy/transmission/Pages/default.aspx

Edmonson County. (2007, August 9). *Mammoth Cave National Park*. Retrieved December 30, 2015, from http://www.edmonsoncounty.ky.gov/departments/mcnp.htm

EIA. (2012). *Coal Explained - Where Our Coal Comes From*. Retrieved December 2013, from http://www.eia.gov/energyexplained/index.cfm?page=coal_where

EIA. (2013a). *U.S. Energy Mapping System*. Retrieved September 2013, from http://www.eia.gov/state/maps.cfm

EIA. (2013b). *Natural Gas Explained*. Retrieved September 2013, from http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_where

EIA. (2013c). *Coal Explained - Coal Mining and Transportation*. Retrieved September 2013, from http://www.eia.gov/coal/

EIA. (2013d). *How many and what kind of power plants are there in the United States?* Retrieved September 2013, from http://www.eia.gov/tools/faqs/faq.cfm?id=65&t=21

Encyclopedia Britannica. (2013). *Southwest Region*. Retrieved December 2013, from http://www.britannica.com/EBchecked/topic/556966/Southwest

Encyclopedia Britannica. (2014, June 2). *Mountain Ecosystem*. Retrieved December 15, 2015, from Encyclopedia Britannica Online: http://www.britannica.com/science/mountain-ecosystem

EPA. (1973, July 27). *EPA.gov.* Retrieved 08 05, 2015, from National Service Center for Environmental Publications - Impact Characterization of Noise: http://nepis.epa.gov/Exe/ZyNET.exe/9101DPQN.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&F

EPA. (1974). *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* Washington, D.C.: EPA. Retrieved from https://nepis.epa.gov/Exe/ZyNET.exe/2000L3LN.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&

EPA. (1993, January 31). *Habitat Evaluation: Guidance for the Review of Environmental Impact Assessment Documents.* Retrieved February 2015, from http://www.epa.gov/compliance/resources/policies/nepa/habitat-evaluation-pg.pdf

EPA. (2007a). *Region 3 Water Protection Division Sole Source Aquifer Program*. Retrieved September 2013, from http://www.epa.gov/reg3wapd/presentations/ssa/index.htm

EPA. (2007b). *National Estuary Program Coastal Condition Report -- Chapter 7: Puerto Rico: San Juan Bay Estuary Partnership Coastal Condition*. Retrieved October 2013, from http://water.epa.gov/type/oceb/nep/upload/nepccr_pr_parta.pdf

EPA. (2007c). *Municipal Solid Waste in the United States - Facts and Figures.* Retrieved September 2013, from http://www.epa.gov/osw/nonhaz/municipal/pubs/msw07-rpt.pdf

EPA. (2008a). *Sole Source Aquifer Program: EPA Region 1*. Retrieved December 2013, from http://www.epa.gov/region1/eco/drinkwater/pc_solesource_aquifer.html

EPA. (2008b). *Combined Sewer Overflows Demographics*. Retrieved September 2013, from http://cfpub.epa.gov/npdes/cso/demo.cfm

EPA. (2009). *National Lakes Assessment: A Collaborative Survey of the Nation's Lakes.* Retrieved September 2013, from http://www.epa.gov/sites/production/files/2013-11/documents/nla_newlowres_fullrpt.pdf

EPA. (2010a). *Sole Source Aquifers: EPA Region 2*. Retrieved September 2013, from http://www.epa.gov/region02/water/aquifer/

EPA. (2010b). *Coastal Wetlands Initiative: Gulf of Mexico Review.* Retrieved from http://water.epa.gov/type/wetlands/upload/gulf-of-mexico-review.pdf

EPA. (2011a). *New England's Drinking Water*. Retrieved November 2013, from http://www.epa.gov/region1/eco/drinkwater/ne_drinkwater.html

EPA. (2011b). *Water Infrastructure & You.* Retrieved September 2013, from http://water.epa.gov/infrastructure/sustain/upload/EPA_WaterInfrastructureandYou.pdf

EPA. (2011c). *Fiscal Year 2010 Drinking Water and Ground Water Statistics.* Retrieved September 2013, from http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/upload/new_fiscal-year-2010-drinking-water-and-ground-water-statistics.pdf

EPA. (2011d). *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Hazardous Substances*. Retrieved December 2013, from http://www.epa.gov/osweroe1/content/hazsubs/cercsubs.htm

EPA. (2011e). *SARA Overview*. Retrieved December 2013, from http://www.epa.gov/superfund/policy/sara.htm

EPA. (2012a, July 16). *Noise Pollution*. Retrieved August 4, 2015, from http://www.epa.gov/air/noise.html

EPA. (2012b). *Coastal Watershed Factsheets - Oceans and Coastal Protection: Your Coastal Watershed*. Retrieved February 2014, from http://water.epa.gov/type/oceb/fact1.cfm

EPA. (2012c). *National Coastal Condition Report IV.* Retrieved January 14, 2016, from http://www.epa.gov/sites/production/files/2014-10/documents/0_nccr_4_report_508_bookmarks.pdf

EPA. (2012d). *Sole Source Aquifers: EPA Region 6*. Retrieved September 2013, from http://www.epa.gov/region6/water/swp/ssa/maps.htm

EPA. (2012e). *Sole Source Aquifer: EPA Region 9*. Retrieved September 2013, from http://epa.gov/region09/water/groundwater/ssa.html

EPA. (2012f). *Our Nation's Air: Status and Trends Through 2010.* Retrieved July 1, 2015, from http://www.epa.gov/airtrends/2011/report/fullreport.pdf

EPA. (2012g, March 6). *Why are wetlands important?* Retrieved November 16, 2015, from http://water.epa.gov/type/wetlands/people.cfm

EPA. (2012h). *Private Drinking Water Wells*. Retrieved September 2013, from http://water.epa.gov/drink/info/well/index.cfm

EPA. (2012i). *Landfills*. Retrieved September 2013, from http://www.epa.gov/epawaste/nonhaz/municipal/landfill.htm

EPA. (2012j). *Industrial Waste*. Retrieved September 2013, from http://www.epa.gov/epawaste/nonhaz/industrial/index.htm

EPA. (2012k). *Waste Types*. Retrieved December 2013, from http://www.epa.gov/osw/hazard/wastetypes/index.htm

EPA. (2012l). *Treatment, Storage and Disposal (Waste Management) Facilities*. Retrieved December 2013, from http://www.epa.gov/compliance/monitoring/programs/rcra/tsdfs.html

EPA. (2012m). *Love Canal*. Retrieved December 2013, from http://www.epa.gov/region2/superfund/npl/lovecanal/

EPA. (2012n). *NPL Site Narrative for Times Beach*. Retrieved December 2013, from http://www.epa.gov/superfund/sites/npl/nar833.htm

EPA. (2012o). *Brownfields and Land Revitalization*. Retrieved December 2013, from http://www.epa.gov/brownfields/basic_info.htm

EPA. (2012p). *F019 Final Rule Frequent Question*. Retrieved December 2013, from http://www.epa.gov/osw/hazard/wastetypes/wasteid/f019/quests-final.htm

EPA. (2012q). *Climate Change Indicators in the United States 2012.* Retrieved October 2013, from http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

EPA. (2013a). *EJView*. Retrieved from http://epamap14.epa.gov/ejmap/ejmap.aspx?wherestr=United%20States

EPA. (2013b). *Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act*. Retrieved September 2013, from http://www.epa.gov/climatechange/endangerment/

EPA. (2013c). *Rivers and Streams.* Retrieved December 2013, from http://water.epa.gov/type/rsl/

EPA. (2013d). *Water Quality Assessment and Total Maximum Daily Loads*. Retrieved September 2013, from http://ofmpub.epa.gov/tmdl_waters10/attains_index.home

EPA. (2013e). *Sole Source Aquifers in the Southeast*. Retrieved September 2013, from http://www.epa.gov/region4/water/groundwater/r4ssa.html

EPA. (2013f). *Designated Sole Source Aquifers in Region 5*. Retrieved September 2013, from http://www.epa.gov/region5/water/gwdw/solesourceaquifer/index.htm

EPA. (2013g). *National Rivers and Streams Assessment 2008-2009: A Collaborative Survey*. Retrieved September 2013, from http://water.epa.gov/type/rsl/monitoring/riverssurvey/upload/NRSA0809_Report_Final_508Compliant_130228.pdf

EPA. (2013h). *Designated Sole Source Aquifers in EPA Region VII*. Retrieved September 2013, from http://www.epa.gov/safewater/sourcewater/pubs/qrg_ssamap_reg7.pdf

EPA. (2013i). *Region 8 Sole Source Aquifer Program*. Retrieved September 2013, from http://www.epa.gov/region8/water/solesource.html

EPA. (2013j). *An Overview of the Sole Source Aquifer Protection Program in EPA Region 10*. Retrieved September 2013, from http://yosemite.epa.gov/r10/water.nsf/Sole+Source+Aquifers/Overview/

EPA. (2013k). *Pretreatment Frequently Asked Questions*. Retrieved September 2013, from http://cfpub.epa.gov/npdes/faqs.cfm?program_id=3

EPA. (2013l). *Septic Systems for Small Communities*. Retrieved September 2013, from http://www.epa.gov/reg3wapd/septic/

EPA. (2013m). *Municipal Solid Waste*. Retrieved September 2013, from http://www.epa.gov/epawaste/nonhaz/municipal/index.htm

EPA. (2013n). *RCRA Summary*. Retrieved December 2013, from http://www.epa.gov/region02/waste/summary.htm

EPA. (2013o). *Corrective Action*. Retrieved December 2013, from http://www.epa.gov/epawaste/hazard/correctiveaction/index.htm

EPA. (2013p). *Toxics Release Inventory (TRI) Program*. Retrieved December 2013, from http://www2.epa.gov/toxics-release-inventory-tri-program/learn-about-toxics-release-inventory

EPA. (2013q). *Brownfields Federal Programs Guide*. Retrieved December 2013, from http://epa.gov/brownfields/partners/brownfields-federal-programs-guide-2013.pdf

EPA. (2013r). *Geospatial Data Download Service (Brownfields)*. Retrieved December 2013, from http://www.epa.gov/envirofw/geo_data.html

EPA. (2013s). *FEMA Map Service Center*. Retrieved December 2013, from https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1&userType=G

EPA. (2013t). *Cleanups in my Community.* Retrieved October 2013, from http://ofmpub.epa.gov/apex/cimc/f?p=100:63

EPA. (2013u). *Cleanup Sites in Region 5*. Retrieved December 2013, from http://www.epa.gov/region5/cleanup/index.htm#IL

EPA. (2014). *Green Infrastructure*. Retrieved February 2014, from http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm

EPA. (2015a, July 17). *Technology Transfer Network - Basic Information*. Retrieved July 17, 2015, from http://cfpub.epa.gov/oarweb/mkb/basic_information.cfm

EPA. (2015b, January 30). *Designations*. Retrieved April 20, 2015, from http://www.epa.gov/airquality/greenbook/define.html

EPA. (2015c, May). *Sole Source Aquifer Protection Program*. Retrieved July 2015, from http://www.epa.gov/dwssa/overview-drinking-water-sole-source-aquifer-program#What_Is_SSA

EPA. (2015d, November 24). *Information about Local Estuary Programs*. Retrieved from http://www.epa.gov/nep/information-about-local-estuary-programs#tab-1

EPA. (2015e). *What is a Wetland?* Retrieved December 15, 2015, from http://www.epa.gov/wetlands/what-wetland

EPA. (2015f, September 29). *Great Lakes Facts and Figures*. Retrieved January 18, 2016, from EPA: http://www.epa.gov/greatlakes/great-lakes-facts-and-figures

EPA. (2015g). *Invasive Species*. Retrieved June 23, 2015, from http://water.epa.gov/type/oceb/habitat/invasive_species_index.cfm

EPA. (2015h, November 18). *Why are wetlands important?* Retrieved January 24, 2016, from http://www.epa.gov/wetlands/why-are-wetlands-important

EPA. (2015i, November 17). *Wetland Classifications and Types*. Retrieved December 2013, from http://water.epa.gov/type/wetlands/upload/2004_10_25_wetlands_types.pdf

EPA. (2015j). *U.S. and Global Temperature*. Retrieved October 2013, from Climate Change Indicators: http://www3.epa.gov/climatechange/science/indicators/weather-climate/temperature.html

EPA. (2016a, February 23). *Air Quality Trends*. Retrieved June 27, 2016, from https://www.epa.gov/air-trends

EPA. (2016b, June 17). *Green Book Nonattainment Areas*. Retrieved June 27, 2016, from https://www.epa.gov/green-book

EPA. (2016c, November 21). *Underground Storage Tanks (USTs)*. Retrieved from https://www.epa.gov/ust

EPA. (2016d, September 22). *EPA Superfund Program: Chevron Questa Mine, Questa, NM*. Retrieved from https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0600806

EPA. (2016e, November 3). *Environmental Justice*. Retrieved from https://www.epa.gov/environmentaljustice

EPA. (2016f, February). *Atmospheric Concentrations of Greenhouse Gases*. Retrieved from https://www3.epa.gov/climatechange/science/indicators/ghg/ghg-concentrations.html

EPA. (2016g). *Executive Order 13653, Preparing the United States for the Impacts of Climate Change*. Retrieved from Greening EPA: https://www.epa.gov/greeningepa/executive-order-13653-preparing-united-states-impacts-climate-change

EPA. (2016h). *Executive Order 13693, Planning for Federal Sustainability in the Next Decade*. Retrieved from Greening EPA: https://www.epa.gov/greeningepa/executive-order-13693-planning-federal-sustainability-next-decade

EPA. (2016i, February 2). *Climate Change*. Retrieved from https://www3.epa.gov/climatechange/science/indicators/weather-climate/temperature.html

EPA. (2016j, May 6). *Superfund: National Priorities List (NPL)*. Retrieved June 12, 2016, from https://www.epa.gov/superfund/superfund-national-priorities-list-npl

EPA. (2016k). *EJSCREEN*. Retrieved from https://www.epa.gov/ejscreen

EPA. (2017, February). *Section 404 of the Clean Water Act: How Wetlands are Defined and Identified*. Retrieved from Section 404 of the Clean Water Act: https://www.epa.gov/cwa-404/section-404-clean-water-act-how-wetlands-are-defined-and-identified

ESRI. (2015). USFWS/EPA - Critical Habitat by Ecoregion. Retrieved December 29, 2015, from http://maps4.arcgisonline.com/ArcGIS/rest/services/DOI/USFWS-EPA_Critical_Habitat_by_Ecoregion/MapServer

ESRI. (2016, March 1). National Park Service World Physical Map. Retrieved January 15, 2016, from http://goto.arcgisonline.com/maps/World_Physical_Map

Ewing, R., Pendall, R., & Chen, D. (2002). *Measuring Sprawl and Its Impact.* Retrieved October 2013, from http://www.smartgrowthamerica.org/research/measuring-sprawl-and-its-impact/

Executive Order 13112. (1999, February 3). *USDA National Agricultural Library*. Retrieved July 17, 2015, from National Invasive Species Information Center: http://www.invasivespeciesinfo.gov/laws/execorder.shtml

FAA. (2012, April 05). *Advisory Circular AC 36-3H*. Retrieved 07 22, 2015, from http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC36-3H%20Chg%201.pdf

FAA. (2015, 08 05). *FAA Pilot Safety Brochure - Hearing and Noise in Aviation.* Retrieved 08 05, 2015, from FAA.gov: https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hearing_brochure.pdf

Fang, D. (2012). *After the Storm: Impacts of natural disasters in the United States at the state and county level.* Retrieved December 2013, from http://econ.duke.edu/uploads/media_items/danjie-fang-thesis.original.pdf

Fears, D. (2013). *IPCC report says humans almost certainly cause global warming.* Retrieved October 2013, from http://articles.washingtonpost.com/2013-09-27/national/42442003_1_climate-scientists-carbon-emissions-climate-models

FedCenter. (2015, October 20). *NEPA*. Retrieved from Program Areas: https://www.fedcenter.gov/programs/nepa/

Federal Register. (2013). *Pipeline Safety: Potential for Damage to Pipeline FAcilities Caused by Flooding*. Retrieved December 2013, from https://www.federalregister.gov/articles/2013/07/12/2013-16754/pipeline-safety-potential-for-damage-to-pipeline-facilities-caused-by-flooding

Federal Transit Authority. (2006). *Transit Noise and Vibration Impact Assessment.* FTA. doi:https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf

FEMA. (2005, June). *Reducing Damage from Localized Flooding: A Guide for Communities.* Retrieved from https://www.fema.gov/media-library-data/20130726-1446-20490-0539/FEMA511-complete.pdf

FEMA. (2006a). *44 CFR Section 59.1 of the National Flood Insurance Program (NFIP) Regulations: Definitions of NFIP Terms.* Retrieved January 2014, from http://www.fema.gov/media-library/assets/documents/12437?id=3064

FEMA. (2006b). *Managing Floodplain Development through the NFIP*. Retrieved September 2013, from http://www.fema.gov/media-library/assets/documents/6029?id=2108

FEMA. (2008). *Hurricane Ike Impact Report.* Retrieved October 2013, from http://www.fema.gov/pdf/hazard/hurricane/2008/ike/impact_report.pdf

FEMA. (2010). *Unit II: Coastal Environment.* Retrieved February 15, 2015, from Residential Coastal Construction: https://training.fema.gov/emiweb/is/is386/is386unit_2.pdf

FEMA. (2011a). *Coastal Flood and Wind Event Summaries*. Retrieved October 2013, from Coastal Construction Manual Resources: http://greatlakesresilience.org/sites/default/files/library_reports_2011_FEMA_CoastalFloodandWindEventSummaries.pdf

FEMA. (2011b). Retrieved January 23, 2016, from Presidential Disaster Declarations December 24, 1964 to December 31, 2011: http://gis.fema.gov/maps/FEMA_Presidential_Disaster_Declarations_1964_2011.pdf

FEMA. (2012a). *Executive Order 11988: Floodplain Management*. Retrieved October 2013, from http://www.fema.gov/environmental-planning-and-historic-preservation-program/executive-order-11988-floodplain-management

FEMA. (2012b). *Floodplain Management Fact Sheet*. Retrieved September 2013, from http://www.fema.gov/national-flood-insurance-program-2/floodplain-management-fact-sheet#2

FEMA. (2013a). *FEMA GIS Data Feeds*. Retrieved September 2013, from http://gis.fema.gov/DataFeeds.html

FEMA. (2013b). *National Flood Insurance Program Community Rating System Coordinator's Manual. 2013 Edition.* Retrieved from https://www.fema.gov/media-library/assets/documents/8768?id=2434

FEMA. (2013c). *National Flood Insurance Program (NFIP) Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials.* Retrieved April 2014, from Unit 3: NFIP Flood Studies and Maps: http://www.fema.gov/media-library-data/20130726-1539-20490-0241/nfip_sg_unit_3.pdf

FEMA. (2013d). *Significant Flood Events*. Retrieved October 2013, from http://www.fema.gov/significant-flood-events

FEMA. (2013e). *Disaster Declarations by State/Tribal Government*. Retrieved October 2013, from http://www.fema.gov/disasters/grid/state-tribal-government

FEMA. (2013f). *Federal Guidelines for Dam Safety*. Retrieved from https://s3-us-gov-west-1.amazonaws.com/dam-production/uploads/5b20db599c212f77fd5e85d256f471a3/EAP%20Federal%20Guidelines_FEMA%20P-64.pdf

FEMA. (2013g). *Disaster Declarations*. Retrieved October 2013, from http://www.fema.gov/disasters

FEMA. (2013h). *Hurricane Sandy Recovery Efforts One Year Later*. Retrieved February 2014, from http://www.fema.gov/media-library/assets/documents/85068

FEMA. (2013i). *National Fire Department Census Quick Facts*. Retrieved October 2013, from http://apps.usfa.fema.gov/census/summary.cfm#c

FEMA. (2013j). *Colorado Flooding - 100 Days Later*. Retrieved February 2014, from http://www.fema.gov/news-release/2013/12/20/colorado-flooding-100-days-later

FEMA. (2015a, March 30). *Final Report: Reducing Losses through Higher Regulatory Standards: Best Practices and Cost-Effective Strategies Report.* Retrieved from https://www.fema.gov/media-library-data/1429759809776-2d0be16f764d0e704aff1f7664334ba0/FEMA_CO_BestPractices_Strategies.pdf

FEMA. (2015b). *National Flood Insurance Program Biological Evaluation.* Version 2.0, Revised Draft dated December 28, 2015, Washington, DC.

FEMA. (2016). *FEMA's National Flood Hazard Layer*. Retrieved from https://fema.maps.arcgis.com/home/item.html?id=cbe088e7c8704464aa0fc34eb99e7f30

FEMA. (2016). *Special Flood Hazard Area.* Retrieved from Special Flood Hazard Area: http://www.fema.gov/special-flood-hazard-area

FEMA. (Undated). *Chapter 2: Types of Floods and Floodplains*. Retrieved September 2013, from http://training.fema.gov/EMIWeb/edu/docs/fmc/Chapter%202%20-%20Types%20of%20Floods%20and%20Floodplains.pdf

Fenneman, N. (1916). *Physiographic Subdivision of the United States.* Retrieved April 2015, from http://www.pnas.org/content/3/1/17.full.pdf?ck=nck

FHWA. (2011, March). *National Highway Planning Network*. Retrieved November 2013, from Version 11.09: http://www.fhwa.dot.gov/planning/processes/tools/nhpn/2011/

FHWA. (2013a). *Learn About Byways*. Retrieved September 2013, from http://byways.org/learn/

FHWA. (2013b). *Freight Management and Operations: Demands on the Transportation System*. Retrieved September 2013, from http://ops.fhwa.dot.gov/freight/freight_analysis/freight_story/demands.htm

FHWA. (2013c). *Bridges & Structures: Highway Tunnel Inventory*. Retrieved September 2013, from http://www.fhwa.dot.gov/bridge/tunnel/management/summary.cfm

FHWA. (2014). *Explore Byways*. Retrieved September 2013, from http://byways.org/explore/

FHWA. (Undated). *America's Byways*. Retrieved October 2013, from http://www.fhwa.dot.gov/byways/

FIMA. (2016, October). CRS Communities Receiving Credit for Land Use and Planning-Related Activities.

Florida Department of Environmental Protection. (2014). *Florida Geological Survey: Hazards - Landslides*. Retrieved March 2015, from http://www.dep.state.fl.us/geology/geologictopics/hazards/landslides.htm

Florida Park Service. (2015). *Florida State Parks*. Retrieved December 29, 2015, from Welcome to Florida Caverns State Park: https://www.floridastateparks.org/park-history/Florida-Caverns

Flyways.us. (2008). *General Flyways Info*. Retrieved October 2013, from http://www.flyways.us/flyways/info

FRA. (2013). *Accident Detail Report*. Retrieved December 2013, from http://safetydata.fra.dot.gov/officeofsafety/publicsite/Query/incrpt.aspx

FRA. (2015). *Horn Noise FAQ*. Retrieved 07 22, 2015, from Federal Railroad Administration: https://www.fra.dot.gov/Page/P0599

FRA. (Undated). *About FRA*. Retrieved December 2013, from https://www.fra.dot.gov/Page/P0002

Furchtgott-Roth, D. (2013). *Pipelines Are Safest for Transportation of Oil and Gas*. Retrieved September 2013, from http://www.manhattan-institute.org/html/ib_23.htm#notes

Georgia Department of Natural Resources. (Undated). *Comprehensive Inventory – Chapter 3 (Piedmont)*. Retrieved September 2013, from http://www1.gadnr.org/greenspace/c_pdfs/21ciCh3Pied001.pdf

Georgia Mining Association. (2013). *Georgia's Kaolin Industry - Employment, Economic & Environmental Impact*. Retrieved December 2013, from http://www.georgiamining.org/GMA-georgia-kaolin-industry.php

Georgia Sea Grant. (2015). *Beach Ecology*. Retrieved December 29, 2015, from Georgia Sea Grant: http://georgiaseagrant.uga.edu/article/beach_ecology/

Godt, J. (2012). *Prototype Landslide Hazard Map of the Conterminous United States*. Retrieved September 2013, from http://landslides.usgs.gov/docs/coe/GodtCoeBaumHighlandHazardMap.pdf

Goenaga, C., & Boulon, Jr., R. H. (1992, February). *The State of Puerto Rican and U.S. Virgin Islands Corals: An Aid to Managers.* Retrieved from Appendix I, Caribbean Fisheries Management Council: http://www.caribbeanfmc.com/fmp%20coral/co%20app%20I.PDF

Gonzalez, A., Garnick, C., & Broom, J. (2014). 3 die in mudslide east of Arlington, 6 homes destroyed. *Seattle Times*. Retrieved August 2014, from http://seattletimes.com/html/localnews/2023201818_mudslidexml.html

Good, J. (2015). *Estuarine Science, Management, and Restoration.* Retrieved January 12, 2016, from Master Watershed Stewards Handbook: http://www.oregon.gov/dsl/ssnerr/docs/wsep.pdf

Goodrich, G. (2009). *How will climate change affect the Great Lakes?* Retrieved October 2013, from http://blogs.ei.columbia.edu/2009/12/22/how-will-climate-change-affect-the-great-lakes/

Gorte, R., Vincent, C. H., Hanson, L. A., & Rosenblum, M. A. (2012). *Federal Land Ownership: Overview and Data.* Retrieved December 2013, from http://www.fas.org/sgp/crs/misc/R42346.pdf

Government Publishing Office. (2015a). *Electronic Code of Federal Regulations Title 50, Part 17 Endangered and Threatened Wildlife*. Retrieved April 4, 2015, from Last Updated April 2, 2015: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=186cb0f38a1b1b6770e432a7eba20553&rgn=div8&view=text&node=50:2.0.1.1.1.2.1.1&idno=50

Government Publishing Office. (2015b). *Electronic Code of Federal Regulations Title 50, Part 17 Endangered and Threatened Plants*. Retrieved April 4, 2015, from http://www.gpo.gov/fdsys/pkg/CFR-2012-title50-vol2/pdf/CFR-2012-title50-vol2-sec17-12.pdf

Gramly. (1996). *The Wenatchee Clovis Site (Richey-Roberts Site): a summary of findings and current status*. Retrieved from csfa.tamu.edu/wp-content/uploads/2015/12/1996_v13.pdf

Gramly. (1998). *Pit Features at the East Wenatchee Site and Elsewhere*. Retrieved from csfa.tamu.edu/wp-content/uploads/2015/12/1998_v15.pdf

Great Lakes Science Advisory Board to the International Joint Commission. (2010). *Groundwater in the Great Lakes Basin.* Retrieved December 2013, from http://www.ijc.org/files/publications/E43.pdf

Great Lakes St. Lawrence Seaway System. (2015). *A Vital Waterway*. Retrieved October 2013, from http://www.greatlakes-seaway.com/en/seaway/vital/index.html

Greenbelt Alliance. (2012). *Urban Growth Boundaries.* Retrieved October 2013, from http://www.greenbelt.org/wp-content/uploads/2012/02/ugb.pdf

Gulf Coast Ecosystem Restoration Council. (2013). *Final Programmatic Environmental Assessment for the Initial Comprehensive Plan: Restoring the Gulf Coast's Ecosystem and Economy.* Retrieved February 2014, from http://www.restorethegulf.gov/sites/default/files/Final%20PEA%20Table%20of%20Contents.pdf

Haas, D. (2013). *About the WSR Act*. Retrieved September 2013, from http://www.rivers.gov/wsr-act.php

Hamilton County Soil & Water Conservation District. (2011). *Landslides in Hamilton County*. Retrieved September 2013, from http://www.hcswcd.org/uploads/1/5/4/8/15484824/landslides_in_hamilton_county_hcswcd_2011.pdf

Hampson, P. T., Johnson, G., Ahlstedt, S., & Connell, J. (2000). *Water Quality in the Upper Tennessee River Basin, Tennessee, North Carolina, Virginia, and Georgia 1994–98.* Herndon, Virginia: U.S. Geological Survey Circular 1205. Retrieved November 5, 2013, from http://pubs.water.usgs.gov/circ1205

Hapke, C., Himmelstoss, E., Kratzmann, M., List, J., & Thieler, E. (2010). *National Assessment of Shoreline Change: Historical shoreline change along the New England and Mid-Atlantic coasts: U.S. Geological Survey Open- File Report 2010-1118.* Retrieved January 2016, from http://pubs.usgs.gov/of/2010/1118/pdf/ofr2010-1118_report_508_rev042312.pdf

Harrington, W., & Nelson, P. (2006). *Public Treatment of Private Waste: Industrial Use of Municipal Wastewater Treatment.* Retrieved September 2013, from http://www.rff.org/rff/Documents/RFF-Rpt-WastewaterTreatment.pdf

Hauer, M. E., & Evans, J. M. (2016). *Millions projected to be at risk from sea-level rise in the continental United States.* Retrieved from http://paa2015.princeton.edu/uploads/153817

Hawaii Coastal Management Program. (2010). *Section 309 Assessment and Strategy FY 2011-2015.* Retrieved October 2013, from http://coastalmanagement.noaa.gov/mystate/docs/hi3092011.pdf

Hawaii Department of Land and Natural Resources. (2015). *Wildlife Programs*. Retrieved December 2, 2015, from State of Hawaii Division of Forestry and Wildlife: http://dlnr.hawaii.gov/wildlife/

Headwaters Regional Development Commission. (2002). *Mitigation Ideas: Possible Mitigation Measures by Hazard Type*. Retrieved December 2013, from http://www.hrdc.org/html/hazard-mitigation-docs/Hazard-Mitigation-Ideas.pdf

Hebert, P. J. (1980). Atlantic Hurricane Season of 1979. *Monthly Weather Review*. Retrieved February 2014, from http://journals.ametsoc.org/doi/abs/10.1175/1520-0493%281980%29108%3C0973%3AAHSO%3E2.0.CO%3B2

Henshall, G. (2008). *Debris piled against a bridge in Iowa*. Retrieved December 2013, from http://www.fema.gov/media-library/assets/images/53073

Homeland Security Infrastructure Program (Gold 2012). (2011a). Oil and Natural Gas Pipelines. *Platts / Energy*.

Homeland Security Infrastructure Program (Gold 2012). (2011b). Electric Power Generating Plants. *Ventyx / Energy*.

Homeland Security Infrastructure Program (Gold 2012). (2011c). Nuclear Power Plants. *Ventyx / Energy*.

Homeland Security Infrastructure Program (Gold 2012). (2011d). North American Electric Reliability Corporation (NERC) Regions. *Ventyx / Energy*.

Homeland Security Infrastructure Program (Gold 2012). (2011e). Transmission Lines. *Ventyx / Energy*.

Honolulu Authority for Rapid Transportation. (2012). *Traditional Cultural Properties Report Honouliuli Ahupuaʻa: Honolulu Rail Transit Project Technical Memorandum.* Retrieved December 2013, from http://www.honolulutransit.org/media/154888/20120301-Honouliuli-TCP-Report-Tech-Memo.pdf

Hupp, C., Noe, G., & Schenk, E. (2010). *Floodplains, Equilibrium, and Fluvial Impacts of Human Alterations.* Retrieved September 2013, from http://profile.usgs.gov/myscience/upload_folder/ci2012Feb1708481027921Hupp%20et%20al%202010%20FISC.pdf

Illinois Department of Natural Resources. (2013). *Historic Floods on the Missouri River.* Retrieved October 2013, from http://dnr.ne.gov/floodplain/mitigation/mofloods.html

Internal FEMA report. (2015, April 30). Estimating Future Base Flood Discharges to Account for Climate Change and Population Growth.

International Atomic Energy Agency. (Undated). *IAEA Safety Standards - Meteorological and Hydrologoical Hazards in Site Evaluation for Nuclear Installations*. Retrieved April 2014, from http://www-pub.iaea.org/MTCD/publications/PDF/Pub1506_web.pdf

IPCC. (2007). *Climate Change 2007: Synthesis Report.* Retrieved October 2013, from www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Retrieved from http://www.climatechange2013.org/report/

Jameson, J. (2013). *Big Bend National Park*. Retrieved October 2013, from http://www.tshaonline.org/handbook/online/articles/gkb02

Jamieson, G. S. (1993, December 1). *Marine Invertebrate Conservation: Evaluation of Fisheries Over-exploitation Concerns.* Retrieved July 20, 2016, from http://az.oxfordjournals.org/content/33/6/551

Jennings, J. D. (1974). *Prehistory of North America.* New York, NY: McGraw-Hill, Inc.

Johnsgard, P. A. (2015). *Global Warming and Population Responses among Great Plains Birds.* Retrieved January 22, 2016, from Zea E-Books. Book 26: http://digitalcommons.unl.edu/zeabook/26

Johnson, K. (2008). *Geologic History of Oklahoma.* Retrieved December 2015, from http://www.ogs.ou.edu/pubsscanned/EP9_2-8geol.pdf

Jordan, W., & Litwack, L. (1987). *The United States; Conquering a Continenty.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Kansas Geological Survey. (1978). *Land Subsidence Areas Associated with Salt Mining – Hutchinson, Kansas: Local Geology – Salt Resources*. Retrieved September 2013, from http://www.kgs.ku.edu/Publications/Bulletins/214/04_land.html

Kansas Geological Survey. (2011). *Groundwater legal framework and management practices in the High Plains Aquifer, USA*. Retrieved September 2013, from http://www.kgs.ku.edu/General/Personnel/rs/mas/2011/Sophocleous_IAHRmonograph.pdf

Karl, T. R., & Koss, W. J. (1984). *Regional and National Monthly, Seasonal, and Annual Temperature Weighted by Area, 1895-1983.* NOAA National Climate Data Center. Asheville, NC: National Climatic Data Center. Retrieved January 2014, from http://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php#references

Karle, & Densmore. (1994). *Stream and Floodplain Restoration in a Riparian Ecosystem Disturbed by Placer Mining*.

Keen, J. (2010). Iowa town nearly wiped off map by floods fighting for survival. *USA Today*. Retrieved February 2014, from http://usatoday30.usatoday.com/weather/floods/2010-03-14-floods_N.htm?csp=N009

Kelly. (2016). *Overview of the Industrial Revolution*. Retrieved from americanhistory.about.com/od/industrialrev/a/indrevooverview.htm

Kenny, J., Barber, N., Hutson, S., Linsey, K., Lovelace, J., & and Maupin, M. (2014). *Estimated Use of Water in the United States in 2010: U.S. Geological Survey Circular 1344.* Retrieved January 2016, from http://pubs.usgs.gov/circ/1405/

Kentucky Educational Television. (2013). *27 Coal- Mining States*. Retrieved September 2013, from http://www.ket.org/Trips/Coal/AGSMM/agsmmwhere.html

King, A. (2002). *Mississippian Period: Overview*. Retrieved from http://www.georgiaencyclopedia.org/articles/history-archaeology/mississippian-period-overview

Kishtawal, C. M., Jaiswal, N., Singh, R., & Niyogi, D. (2012). *Tropical cyclone intensification trends during satellite era (1986-2010).* Retrieved from http://onlinelibrary.wiley.com/doi/10.1029/2012GL051700/full

Knabb, R. R. (2006). *Tropical Cyclone Report Hurricane Katrina.* Retrieved October 2013, from http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf

Kneebone, E., Nadeau, C., & Berube, A. (2011). *The Re-Emergence of Concentrated Poverty: Metropolitan Trends in the 2000s.* Retrieved January 2014, from http://www.brookings.edu/research/papers/2011/11/03-poverty-kneebone-nadeau-berube

Konikow, L. (2013). *Groundwater Depletion in the United States (1900-2008).* Retrieved October 2013, from http://www.wrri.msstate.edu/pdf/Groundwater%20Depletion%20in%20U%20S%20.pdf

Kost, M. (2010, June). *Dry Sand Prairie*. Retrieved December 30, 2015, from http://mnfi.anr.msu.edu/abstracts/ecology/Dry_sand_prairie.pdf

Kost, M., & Slaughter, B. (2009). *Mesic Sand Prairie.* Retrieved December 30, 2015, from http://mnfi.anr.msu.edu/abstracts/ecology/Mesic_sand_prairie.pdf

Kost, M., Albert, D., Cohen, J., Slaughter, B., Schillo, R., Weber, C., & Chapman, a. K. (2014a, November 25). *Cave*. Retrieved December 30, 2015, from Michigan's Natural Communities: http://mnfi.anr.msu.edu/communities/community.cfm?id=10683

Kost, M., Albert, D., Cohen, J., Slaughter, B., Schillo, R., Weber, C., & Chapman, a. K. (2014b, November 26). *Limestone Cliff*. (Michigan Natural Features Inventory, Report No. 2007-21) Retrieved December 30, 2015, from Natural Communities of Michigan: Classification and Description: http://mnfi.anr.msu.edu/communities/community.cfm?id=10703

Kotkin, J. (2011). *The Sun Belt's Comeback*. Retrieved April 2014, from http://www.forbes.com/sites/joelkotkin/2011/12/22/the-sun-belts-comeback/

Kousky, C. (2013). *Informing Climate Adaptation: A Review of the Economic Costs of Natural Disasters, Their Determinants, and Risk Reduction Options.* Retrieved February 2014, from http://www.rff.org/rff/Documents/RFF-DP-12-28.pdf

Langrehr, H. (2000, May 24). *Aquatic Plants of the Upper Mississippi River.* Retrieved January 3, 2016, from http://www.umesc.usgs.gov/multimedia/presentations/aqua_2.pdf

Lithochimeia, LLC. (2009). *The History of Poultry Waste Contamination in the Illinois River Watershed as Determined from Sediment Cores Collected from Tenkiller Ferry Reservoir*. Retrieved December 2013, from http://lithochim.com/documents/isest01%20paper.pdf

Litwack, L. F. (1991). *The United States: Becoming a World Power.* Englewood Cliffs, NJ: Prentice-Hall.

Lopez-Trujillo, D. (2010). *Real Time Flood Alert System (RTFAS) for Puerto Rico.* Guaynabo, Puerto Rico: U.S. Geological Survey. Retrieved from http://pubs.usgs.gov/of/2010/3029/

Louisiana Department of Environmental Quality. (2014). *2014 Louisiana Water Quality Inventory: Integrated Report.* Retrieved from http://www.deq.louisiana.gov/portal/Portals/0/planning/305b/2014/14%20IR1%20A-Master%20File%20Text%20REVISED%2009-19-14.pdf

Love, D. (2015). *What Decision Makers Should Know about Soils in New Mexico.* Retrieved November 2015, from https://geoinfo.nmt.edu/geoscience/hazards/collabsible.html

Lowry, H., Lill, A., & Wong, B. B. (2013). *Behavioural Responses of Wildlife to Urban Environments.* Monash University, School of Biological Sciences. Victoria: Biological Reviews. Retrieved November 17, 2015, from http://www.researchgate.net/publication/234030957_Behavioural_responses_of_wildlife_to_urban_environments

Mac, M. J., Opler, P. A., Haecker, C. E., & Doran, P. D. (1998). *Status and Trends of the Nation's Biological Resources: Regional Trends of Biological Resources - Mississippi River.* Retrieved September 2013, from U.S. Department of the Interior, U.S. Geological: http://www.nwrc.usgs.gov/sandt/Misisipi.pdf

Maine Department of Transportation. (2013). *Explore Magnificent Penobscot Bay with the Maine State Ferry Service*. Retrieved September 2013, from http://www.maine.gov/mdot/msfs/

Mallakpour, I., & Villarini, G. (2015). The Changing Nature of Flooding Across the Central United States. *Nature Climate Change*, 250-254. Retrieved from http://www.readcube.com/articles/10.1038/nclimate2516

Malmstadt, J. K. (2009). Florida Hurricanes and Damage Costs. *Southeastern Geographer*. Retrieved February 2014, from http://www.researchgate.net/publication/228467128_Florida_hurricanes_and_damage_costs/file/d912f50b6900309369.pdf

Mass Aerospace. (2012). *Mass Aerospace Council*. Retrieved December 2013, from http://www.massaerospace.com/

Massachusetts Executive Office of Energy and Environmental Affiars. (Undated). *What is Freeboard? - Raise Your Home, Lower Your Payments.* Retrieved August 2014, from http://www.mass.gov/eea/docs/czm/stormsmart/ssc/ssc5-freeboard.pdf

Masters, J. (Undated). *Remember Hurricane Hugo*. Retrieved October 2013, from http://www.wunderground.com/hurricane/hugo_day_10.asp

Masterson, J. P., Pope, J. P., Monti Jr, J., & Nardi, M. R. (2011). *Assessing Groundwater Availability in the Northern Atlantic Coastal Plain Aquifer System.* Retrieved December 2013, from http://pubs.usgs.gov/fs/2011/3019/pdf/fs2011-3019_masterson_508.pdf

Maupin, M., & Barber, N. (2005). *Regional Assessment of Groundwater Quality in the Mississippi Embayment-Texas Coastal Uplands Aquifer System, Coastal Lowlands Aquifer System, and the Edwards-Trinity Aquifer System.* Retrieved July 2013, from http://pubs.usgs.gov/circ/2005/1279/

Mayo, A., & Post, L. (1971). *Glacier Dammed Lakes and Outburst Floods in Alaska.* Retrieved 2015, from USGS Hydrologic Investigations Atlas HA-455: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwis6I6L2JPKAhUH1RoKHcgaC2YQFggcMAA&url=http%3A%2F%2Firmafiles.nps.gov%2Freference%2Fholding%2F489929&usg=AFQjCNG1tXTZ3ums3R5qw-oeb0kh7nHL9Q&sig2=x-vkoPObmnEjtM4tCiPFEg

McGarigal, K., Cushman, S., & Regan, C. (2005, August 12). *Quantifying Terrestrial Habitat Loss and Fragmentation: A Protocol.* Amherst, MA: University of Massachusetts. Retrieved February 2015, from University of Massachusetts Amherst: http://www.umass.edu/landeco/teaching/landscape_ecology/labs/fragprotocol.pdf

Means, B. K. (2014). *Late Woodland Period (AD 900-1650)*. Retrieved February 14, 2017, from Encyclopedia Virginia: http://www.encyclopediavirginia.org/Late_Woodland_Period_AD_900-1650#start_entry

Medlock, S. (2010). *Flood Preparedness and Mitigation: Map Modernization, Levee Inspection, and Levee Repairs.* Retrieved November 2013, from http://www.leveesafety.org/docs/MedlockTestimonySDRSLPSPI72810.pdf

Melillo, J., Richmond, T., & Yohe, G. (2014). *Climate Change Impacts in the United States: The Third National Climate Change Assessment.* U.S. Global Change Research Program.

Michigan Tech Alumni Association. (Undated). *Snowfall Records*. Retrieved October 2013, from http://www.mtu.edu/alumni/favorites/snowfall/snowfall.html

Middle Rio Grande Conservancy District. (2016). *A Little History: MRGCD Over the Years.* Retrieved January 14, 2016, from http://mrgcd.com/uploads/FileLinks/96e0764000684943bee9dd0800a87926/History%20of%20the%20Conservancy.pdf

Millennium Ecosystem Assessment. (2005). *Ecosystems and Human Well-Being: Synthesis.* Retrieved October 2013, from www.unep.org/maweb/documents/document.356.aspx.pdf

Miller, J. A. (1999). *Aquifer Basics: Unconsolidated and semiconsolidated sand and gravel aquifers*. Retrieved April 2014, from https://water.usgs.gov/ogw/aquiferbasics/uncon.html

Milliken, R., Fitzgerald, R., Hylkema, M., Groza, R., Origer, T., Bieling, D., . . . Fredrickson, D. (2007). *Punctuated Culture Chagne in the San Francisco Bay Area*. Retrieved from https://www.researchgate.net/publication/256521471_Punctuated_Culture_Change_in_the_San_Francisco_Bay_Area

Mississippi Department of Environmental Quality. (2008). *Mississippi Coastal Streams Basin Citizens' Guide.* Retrieved March 2014, from http://www.deq. state.ms.us/MDEQ.nsf/pdf/WMB_CoastalCitizenGuide112008/$File/Coastal%20 St%20Cit%20Guide.pdf?OpenElement

Mississippi Department of Marine Resources. (2010). *CZMA Section 309 Assessment & Strategy 2011 – 2015.* Retrieved January 2016, from https://coast.noaa.gov/czm/enhancement/media/ms3092011.pdf

Missouri Department of Natural Resources. (2015). *Facts about the New Madrid Seismic Zone*. Retrieved October 2015, from http://dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm

Missouri Department of Natural Resources. (Undated). *History of Lead Mining in Missouri*. Retrieved December 2013, from http://www.dnr.mo.gov/env/hwp/sfund/history-mo-lead.htm

Montana Department of Environmental Quality. (2014). *Red Lodge Drilling Investigation - Red Lodge, Montana.* Retrieved October 2015 , from http://www.deq.mt.gov/AbandonedMines/pdfs/ProjectDocuments/RedLodge/2014Red%20Lodge%20Program%20Fact%20Sheet.pdf

Montana Department of Environmental Quality. (2015). *Priority Mine Sites*. Retrieved October 2015, from http://www.deq.mt.gov/AbandonedMines/priority.mcpx

Montana Department of State Lands. (1995). *Abandoned Hardrock Mine Priority Sites - 1995 Summary Report.* Retrieved October 2015, from http://www.deq.mt.gov/abandonedmines/pdfs/Inventory/1-PrioritySitesFrontMatter.pdf

MRLC. (2014, January 31). *NLCD Evaluation, Visualization, and Analysis (EVA) Tool*. Retrieved January 23, 2016, from Multi-Resolution Land Characteristics Consortium: http://www.mrlc.gov/eva/viewer.html

MRLC. (2015, October 1). *Multi-Resolution Land Characteristics Consortium (MRLC)*. Retrieved January 26, 2016, from National Land Cover Database (NLCD) 2011: http://www.mrlc.gov/nlcd2011.php

NACE International. (2015). *Highways and Bridges*. Retrieved October 2013, from http://www.nace.org/Corrosion-Central/Industries/Highways-and-Bridges/

Narragansett Indian Tribe. (Undated). *Illegal Detribalization*. Retrieved February 14, 2017, from http://www.narragansett-tribe.org/illegal-detribalization.html#.WKMjMW8rLIU

NASA. (2013). *How Does the Changing Earth's Surface Affect Society*. Retrieved September 2013, from http://solidearth.jpl.nasa.gov/PAGES/tect03.html

NASA. (2017). *NASA, NOAA Data Show 2016 Warmest Year on Record Globally*. Retrieved from Release 17-006: https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally

National Atlas of the United States. (2001). *Landslide Incidence and Susceptibility*. Retrieved November 2013

National Atlas of the United States. (2003). *Aquifers*. Retrieved November 2013

National Atlas of the United States. (2012a). *Seismic Hazards*. Retrieved November 2013

National Atlas of the United States. (2012b). *Railroads, One Million-Scale*. Retrieved 2013 November, from http://www.nationalatlas.gov/atlasftp.html?openChapters=%2Cchptrans#chptrans

National Bureau of Economic Research. (2010). *US Business Cycle Expansions and Contractions*. Retrieved October 2013, from http://www.nber.org/cycles.html

National Corn Growers Association. (2013). *World of Corn - 2013 Metric Edition*. Retrieved December 2013, from http://www.ncga.com/upload/files/documents/pdf/publications/WorldofCorn_Metric.pdf

National Flood Insurance Program. (2013). *Flooding & Flood Risks - Dams*. Retrieved September 2013, from http://www.floodsmart.gov/floodsmart/pages/flooding_flood_risks/dams.jsp

National Geospatial Intelligence Agency. (Undated). *World Port Index*. Retrieved January 2014, from http://msi.nga.mil/NGAPortal/MSI.portal?_nfpb=true&_pageLabel=msi_portal_page_62&pubCode=0015

National Hurricane Center. (2012). *Hurricanes in History*. Retrieved October 2013, from http://www.nhc.noaa.gov/outreach/history/

National Institutes of Health. (Undated). *TOXMAP Environmental Health Maps*. Retrieved January 2014, from http://toxmap.nlm.nih.gov/toxmap/combo/download.do

National Invasive Species Information Center. (2016). *Executive Order 13112*. Retrieved December 2016, from Federal Laws and Regulations: https://www.invasivespeciesinfo.gov/laws/execorder.shtml

National Snow and Ice Data Center. (2015). *All About Frozen Ground*. Retrieved December 18, 2015, from https://nsidc.org/cryosphere/frozenground/plants.html

National Weather Service. (2000). *Service Assessment: Hurricane Floyd Floods of September 1999.* Retrieved February 2014, from http://www.nws.noaa.gov/os/assessments/pdfs/floyd.pdf

National Weather Service. (2008). *Service Assessment: Pacific Northwest Storms of December 1-3, 2007.* Retrieved February 2014, from http://www.nws.noaa.gov/os/assessments/pdfs/pac_nw08.pdf

National Weather Service. (2009a). *National Weather Service Glossary*. Retrieved October 2013, from http://www.nws.noaa.gov/glossary/index.php?letter=n

National Weather Service. (2009b). *Service Assessment: Central United States Flooding of June 2008*. Retrieved February 2014, from http://www.nws.noaa.gov/os/assessments/pdfs/central_flooding09.pdf

National Weather Service. (2010). *River Forecast Center Missouri Basin: Historic Flood Events of the Missouri River Basin*. Retrieved October 2013, from http://www.crh.noaa.gov/mbrfc/?n=flood

National Weather Service. (2011). *Service Assessment: Record Floods of Greater Nashville Including Flooding in Middle Tennessee and Western Kentucky, May 1-4, 2010.* Retrieved February 2014, from http://www.nws.noaa.gov/os/assessments/pdfs/Tenn_Flooding.pdf

National Weather Service. (2012a). *Mid-Atlantic River Forecast Center: Top 20 Individual Flood Events*. Retrieved October 2013, from http://www.erh.noaa.gov/marfc/Rivers/FloodClimo/Top_Flood_Crests/Top20_PointsOneEvent.php

National Weather Service. (2012b). *The Missouri/Souris River Floods of May-August 2011.* Retrieved February 2014, from http://www.nws.noaa.gov/os/assessments/pdfs/Missouri_floods11.pdf

National Weather Service. (2013). *Weather Forecast Office Brownsville, Texas: Major Rio Grande Flooding in Starr, Hidalgo (July 2010)*. Retrieved October 2013, from http://www.srh.noaa.gov/bro/?n=2010event_julyriograndeflood

National Wild and Scenic Rivers System. (2013). *Explore Designated Rivers*. Retrieved October 2013, from http://www.rivers.gov/map.php

National Wild and Scenic Rivers System. (2016). *Designated Rivers*. Retrieved January 13, 2016, from http://www.rivers.gov/map.php

Natural Hazards Research and Applications Information Center. (1992). *Floodplain Management in the United States: An Assessment Report.* Retrieved December 2013, from http://www.fema.gov/media-library/assets/documents/432

Natural Resources Conservation Service. (1999, January). *United States Painted Relief.* Retrieved January 18, 2016, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs143_013722

Natural Resources Conservation Service. (2008, January). Retrieved January 3, 2016, from http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/azpmstn7363.pdf

Natural Resources Conservation Service. (2014). *HUC-2 Watersheds*. Retrieved April 2014, from ftp://ftp.ftw.nrcs.usda.gov/wbd/

NatureServe. (2009). *Plant/Animal Records: Puma concolor couguar (Eastern cougar)*. Retrieved December 2014, from http://explorer.natureserve.org/servlet/NatureServe?loadTemplate=tabular_report.wmt&paging=home&save=all&sourceTemplate=reviewMiddle.wmt

NatureServe Explorer. (2015). *Ecological Classifications*. Retrieved March 16, 2015, from http://explorer.natureserve.org/classeco.htm#usvegclassification

Navarrete-Tindall, N. (2009). *Native Plants Adapted to Wetlands.* Retrieved January 3, 2016, from http://www.heartlandwq.iastate.edu/NR/rdonlyres/955066D9-4A3A-4214-93B4-214E7FDAC878/0/HaskellUniversityMay122009aa.pdf

NCDC. (1984). *U.S. Climate Regions*. Retrieved January 2014, from http://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php#references

NCDC. (2013). *U.S Tornado Climatology*. Retrieved October 2013, from http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html

Nebraska Emergency Management Agency. (2014). *State of Nebraska Hazard Mitigation Plan*. Retrieved October 2015, from http://www.nema.ne.gov/pdf/hazmitplan.pdf

New England Fishery Management Council. (1998). *Essential Fish Habitat Description Atlantic Salmon (Salmo salar).* Retrieved January 30, 2015, from http://www.greateratlantic.fisheries.noaa.gov/hcd/salmon.pdf

New Hampshire Department of Environmental Services. (2011). *Suggested Water Quality Testing for Private Wells, Publication No. WD-DWGB-2-1*. Retrieved December 2013, from http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-2-1.pdf

New Hampshire Division of Forests and Lands. (2016). *Maritime Rocky Barren*. Retrieved January 4, 2016, from Division of Forests and Lands: http://www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/photo-index/maritime-rocky-barren.aspx

New Hampshire Fish and Game Department. (2015). *Appendix B: Habitat Profiles.* Retrieved January 4, 2016, from New Hampshire Wildlife Action Plan: http://www.wildlife.state.nh.us/wildlife/documents/wap/introandfrontpages.pdf

New Jersey Department of Environmental Protection. (2008). *New Jersey Wildlife Action Plan.* Retrieved December 29, 2015, from http://www.nj.gov/dep/fgw/ensp/wap/pdf/wap_draft.pdf

New Mexico Department of Game and Fish. (2015, October 1). Retrieved December 31, 2015, from http://www.wildlife.state.nm.us/download/conservation/swap/State-Wildlife-Action-Plan-New-Mexico-Draft-10_02_2015.pdf

New Mexico Environment Department. (2012, December). Retrieved December 31, 2015, from https://www.env.nm.gov/swqb/Wetlands/TechnicalGuides/01/WetlandsTechnicalGuide01-WetlandFunctions.pdf

New York Daily News. (2013). *Metro-North train was going 82 mph on a 30-mph curve before it derailed*. Retrieved December 2013, from http://www.nydailynews.com/new-york/metro-north-derailment-data-recorder-found-article-1.1534730

New York State Department of Environmental Conservation. (2013). *Mining in New York State*. Retrieved December 2013, from http://www.dec.ny.gov/lands/5045.html

New York State Department of Environmental Conservation. (2015). *Combined Sewer Overflow (CSO)*. Retrieved September 2013, from http://www.dec.ny.gov/chemical/48595.html

New York State Department of Environmental Conservation. (2016). *Animals, Plants, and Aquatic Life.* Retrieved January 24, 2016, from http://www.dec.ny.gov/23.html

New York Times. (2011). *Flooding Brings Worries Over Two Nuclear Plants*. Retrieved December 2013, from http://www.nytimes.com/2011/06/21/us/21flood.html?_r=1&

Nicolet Forest Botting Company, Inc. (2013). *Where does drinking water come from?* Retrieved September 2013, from http://www.nicoletwater.com/consider-the-source/drinking-water-source.php

Niemiller, M. L., Fenolio, D. B., & Zigler, K. S. (2012). Retrieved December 29, 2015, from http://www.herpetology.us/niemiller/niemiller_etal_2012c.pdf

Niziol, T. (2013). *Expert: Great Lakes Ice Lagging.* Retrieved October 2013, from http://www.weather.com/news/great-lakes-ice-20130109

NOAA. (2011a). *The Gulf of Mexico at a Glance: A Second Glance.* Retrieved September 2013, from http://stateofthecoast.noaa.gov

NOAA. (2011b). *AKZ213, St Lawrence Island Bering Strait*. Retrieved February 2014, from http://www.webcitation.org/69uwNZi1c

NOAA. (2013a). *Saltwater Intrusion Puts Drinking Water at Risk*. Retrieved April 2014, from http://stateofthecoast.noaa.gov/water_use/groundwater.html

NOAA. (2013b). *Historic Rainfall and Floods in Colorado*. Retrieved November 2013, from http://www.climate.gov/news-features/event-tracker/historic-rainfall-and-floods-colorado

NOAA. (2013c). *Sea Surface Temperature (SST) Contour Charts*. Retrieved December 15, 2015, from Office of Satellite and Product Operations: http://www.ospo.noaa.gov/Products/ocean/sst/contour/

NOAA. (2015a). *What is an Estuary?* Retrieved December 8, 2015, from National Estuarine Research Reserve System: http://nerrs.noaa.gov/about/what-is-an-estuary.html

NOAA. (2015b). *Picture Climate: What Can We Learn From Caves?* Retrieved March 3, 2015, from NOAA National Climatic Data Center: http://www.ncdc.noaa.gov/news/picture-climate-what-can-we-learn-caves

NOAA. (2015c). *NOAA Great Lakes Environmental Research Laboratory*. Retrieved December 3, 2015, from http://www.glerl.noaa.gov/

NOAA. (2015d). *National Ocean Service*. Retrieved February 4, 2015, from What is the EEZ?: http://oceanservice.noaa.gov/facts/eez.html

NOAA. (2015e). *Coral Reef Conservation Program*. Retrieved February 5, 2015, from http://coralreef.noaa.gov/

NOAA. (2015f, August 6). *National Weather Service Climate Prediction Center*. Retrieved June 12, 2016, from Background Information: the North Atlantic Hurricane Season: http://www.cpc.ncep.noaa.gov/products/outlooks/background_information.shtml

NOAA. (2016a). *Historical Floods in the Northeast*. Retrieved January 7, 2016, from http://www.erh.noaa.gov/nerfc/historical/index.html

NOAA. (2016b, July). *How Oil Harms Animals and Plants in Marine Environments*. Retrieved from Office of Response and Restoration: http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/how-oil-harms-animals-and-plants-marine-environments.html

NOAA. (2017). *2016 was 2nd warmest year on record for U.S.* Retrieved from http://www.noaa.gov/news/2016-was-2nd-warmest-year-on-record-for-us

NOAA. (2017). *Trends in Atmospheric Carbon Dioxide, Earth System Research Laboratory*. Retrieved from ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt

NOAA. (2017a). *Global and Regional Sea Level Rise Scenarios for the United States.* Silver Spring, MD: NOAA. Retrieved from https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf

NOAA. (2017b). *Pacific Decadal Oscillation*. Retrieved August 30, 2017, from NOAA National Centers for Environmental Information: https://www.ncdc.noaa.gov/teleconnections/pdo/

NOAA Fisheries. (1999). *Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies.* Retrieved February 5, 2015, from http://www.safmc.net/Library/Ecosystem/EFHMandate.pdf

NOAA Fisheries. (2004). *Essential Fish Habitat Consultation Guidance, Version 1.1.* Retrieved February 13, 2015, from http://www.habitat.noaa.gov/pdf/efhconsultationguidancev1_1.pdf

NOAA Fisheries. (2007). *Magnuson-Stevens Fishery Conservation and Management Act as Amended through January 12, 2007.* Retrieved January 30, 2015, from http://www.nmfs.noaa.gov/sfa/magact/MSA_Amended_2007%20.pdf

NOAA Fisheries. (2012a). *An Overview of Protected Species in the Gulf of Mexico.* Retrieved December 29, 2015, from http://sero.nmfs.noaa.gov/protected_resources/outreach_and_education/documents/protected_species_gom.pdf

NOAA Fisheries. (2012b). *Fisheries Economics of the United States, 2011*. Retrieved February 2014, from http://www.st.nmfs.noaa.gov/economics/publications/feus/fisheries_economics_2011

NOAA Fisheries. (2015a). *What is Essential Fish Habitat?* Retrieved February 4, 2015, from http://www.habitat.noaa.gov/protection/efh/index.html

NOAA Fisheries. (2015b). *Endangered and Threatened Marine Species under NMFS' Jurisdiction*. Retrieved January 30, 2015, from http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals

NOAA Fisheries. (2015c). *Essential Fish Habitat Mapper*. Retrieved February 5, 2015, from http://www.habitat.noaa.gov/protection/efh/efhmapper/

NOAA Fisheries. (2015d). *Southeast Regional Office*. Retrieved February 6, 2015, from Home Page: http://sero.nmfs.noaa.gov/index.html

NOAA Fisheries West Coast Region. (2015). *Rocky Reef*. Retrieved February 2, 2015, from http://www.westcoast.fisheries.noaa.gov/habitat/habitat_types/rocky_reef_info/rocky_reef_habitat_types.html

Noise Pollution Clearinghouse. (2001). *About Noise, Noise Pollution*. Retrieved September 2013, from http://www.nonoise.org

North Carolina Department of Environment and Natural Resources. (2010). *North Carolina Ecosystem Response to Climate Change: Piedmont and Mountain Floodplains*. Retrieved September 2013, from http://www.ncnhp.org/c/document_library/get_file?uuid=24801624-c4db-4982-a85a-7ac77422a58c&groupId=61587

North Carolina Geological Survey. (2004). *Physiography of North Carolina*. Retrieved September 2013, from http://www.geology.enr.state.nc.us/proj_earth/pdf/bw_physiography_600dpi.pdf

North Carolina State University. (1995). *Major Causes of Wetland Loss and Degradation*. Retrieved February 10, 2015, from Water, Soil and Hydro-Environmental Decision Support System: http://www.water.ncsu.edu/watershedss/info/wetlands/wetloss.html

North Pacific Fishery Management Council. (2014). *Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area.* Retrieved January 30, 2015, from http://www.npfmc.org/wp-content/PDFdocuments/fmp/BSAI/BSAIfmp.pdf

Northern Continental Divide Ecosystem. (2013). *Draft NCDE Grizzly Bear Conservation Strategy.* Retrieved March 2015, from http://ecos.fws.gov/docs/recovery_plan/NCDE_Draft_CS_Apr2013_Final_Version_corrected%20headers_1.pdf

NPS. (1973). *National Register of Historic Places, Village of Arden.* Retrieved from https://npgallery.nps.gov/pdfhost/docs/NRHP/Text/73000550.pdf

NPS. (1990). *National Register Bulletin 15.* Retrieved April 2014, from http://www.nps.gov/nr/publications/bulletins/pdfs/nrb15.pdf

NPS. (1991). *Great Basin National Park Water Resources Management Plan*. Retrieved September 2013, from http://www.nature.nps.gov/water/planning/scoping_reports/Great_Basin_screen.pdf

NPS. (1998). *National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties.* Washington, DC: NPS. Retrieved from https://www.nps.gov/nr/publications/bulletins/pdfs/nrb38.pdf

NPS. (2013a). *Hawaii Volcanoes – What's going on with the volcano?* Retrieved September 2013, from http://www.nps.gov/havo/planyourvisit/lava2.htm

NPS. (2013b). *Listings of National Register Properties.* Retrieved September 2013, from National Register of Historic Places: http://nrhp.focus.nps.gov/natreghome.do?searchtype=natreghome

NPS. (2013c). *Lists of National Historic Landmarks.* Retrieved October 2013, from National Historic Landmarks: http://www.nps.gov/nhl/designations/listsofnhls.htm

NPS. (2013d). *Virgin Islands National Park*. Retrieved October 2013, from www.nps.gov/viis/

NPS. (2013e). *About Us*. Retrieved September 2013, from http://www.nps.gov/aboutus/index.htm

NPS. (2013f). *Acadia National Park: Park Statistics*. Retrieved from http://www.nps.gov/acad/parkmgmt/statistics.htm

NPS. (2013g). *Find A Park*. Retrieved October 2013, from http://www.nps.gov/findapark/index.htm

NPS. (2013h). *Everglades National Park*. Retrieved October 2013, from http://www.nps.gov/ever/index.htm

NPS. (2013i). *Great Smoky Mountains National Park*. Retrieved October 2013, from www.nps.gov/grsm/

NPS. (2013j). *Park Statistics (Everglades National Park)*. Retrieved October 2013, from http://www.nps.gov/ever/parkmgmt/statistics.htm

NPS. (2014a, June 16). *National Park Service Science of Sound*. Retrieved 07 22, 2015, from http://www.nature.nps.gov/sound/science.cfm

NPS. (2014b, July 7). *Alaska Parks*. Retrieved from https://www.nps.gov/akso/parks/Index.cfm

NPS. (2014c). *Learn about the National Historic Landmarks Program.* Retrieved April 2014, from http://www.nps.gov/nhl/learn/intro.htm

NPS. (2015a). *Geology of the Coastal Plain.* Retrieved April 2015, from http://www.nps.gov/cue/geology/geo_coastalplain.htm

NPS. (2015b). *Bighorn Canyon -- Cave/Karst Systems.* Retrieved October 2015, from http://www.nps.gov/bica/learn/nature/cave.htm

NPS. (2015c). *Nature*. Retrieved December 2, 2015, from National Park of American Samoa: http://www.nps.gov/npsa/learn/nature/index.htm

NPS. (2015d). *Santa Cruz Island*. Retrieved December 31, 2015, from Channel Islands National Park: http://www.nps.gov/chis/planyourvisit/santa-cruz-island.htm

NPS. (2015e). *Animals: Kenai Fjords National Park*. Retrieved December 31, 2015, from http://www.nps.gov/kefj/learn/nature/animals.htm

NPS. (2015f). *Mammals: Mammoth Cave National Park*. Retrieved December 30, 2015, from http://www.nps.gov/maca/learn/nature/mammals.htm

NPS. (2015g). *Mammals: Jewel Cave National Monument*. Retrieved December 30, 2015, from http://www.nps.gov/jeca/learn/nature/mammals.htm

NPS. (2015h, September 30). *National Register Home*. Retrieved June 10, 2016, from https://www.nps.gov/nr/research/

NPS. (2016a). *The Biology of Caves.* Retrieved January 24, 2016, from Ozark National Scenic Riverways Missouri: http://www.nps.gov/ozar/learn/education/cave-biology.htm

NPS. (2016b). *Fish*. Retrieved January 3, 2016, from Grand Canyon National Park: http://www.nps.gov/grca/learn/nature/fish.htm

NPS. (2016c). *Animals: Mississippi National River and Recreation Area*. Retrieved January 3, 2016, from http://www.nps.gov/miss/learn/nature/animals.htm

NPS. (Undated(a)). *Ocmulgee National Monument Georgia: 17,000 Years of Continuous Human Habitation*. Retrieved February 14, 2017, from https://www.nps.gov/ocmu/index.htm

NPS. (Undated(b)). *National American Indian Heritage Month: Black Hawk Powwow Grounds, Jackson County, Wisconsin*. Retrieved February 14, 2017, from https://www.nps.gov/nr/feature/indian/2009/black_hawk_powwow.htm

NRHP. (2010). *Snoqualmie Falls, King County, Washington*. Retrieved February 14, 2017, from https://www.nps.gov/nr/feature/indian/2010/snoqualmie_falls.htm

Nuclear Regulatory Commission. (Undated). *Radioactive Waste: Production, Storage, Disposal*. Retrieved December 2013, from http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0216/r2/br0216r2.pdf

Oberrecht, K. (2002). *Nonpoint Source Pollution and Pacific Northwest Estuaries.* Retrieved from www.oregon.gov/dsl/ssnerr/docs/emipubs/npspoll.pdf

Occupational Safety and Health Administration. (2016). *OSHA Technical Manual: Noise.* Retrieved May 2016, from Section III: Chapter 5: https://www.osha.gov/dts/osta/otm/new_noise/

Occupational Safety and Health Administration. (Undated(a)). *Fact Sheets on Natural Disaster Recovery: Flood Cleanup*. Retrieved December 2013, from https://www.osha.gov/OshDoc/floodCleanup.html

Occupational Safety and Health Administration. (Undated(b)). *Lead Smelting*. Retrieved December 2013, from https://www.osha.gov/SLTC/etools/leadsmelter/smelting/

Oceana. (2011). *Protecting the Oregon Coast: Identifying and Protecting Important Ecological Areas.* Retrieved January 4, 2016, from http://oceana.org/sites/default/files/reports/Oceana_IEAs_v6.pdf

Ohio Department of Natural Resources. (2005). *Ohio Floodplain Management Handbook.* Retrieved September 2013, from http://www.dnr.state.oh.us/Portals/7/floodpln/oh_floodplain_handbook.pdf

Oklahoma Department of Emergency Management. (2014). *Standard Hazard Mitigation Plan Update for the Great State of Oklahoma.* Retrieved December 2015, from https://www.ok.gov/OEM/documents/Oklahoma%20State%20HM%20Plan%202014.pdf

Oklahoma State Historic Preservation Office. (Undated). *Bassett Grove Ceremonial Grounds*. Retrieved October 2013, from http://www.ocgi.okstate.edu/shpo/shpopic.asp?id=83002085

Oklahoma Water Resources Board. (1995). *1995 Update of the Oklahoma Comprehensive Water Plan: Water Related Issues and Problems*. Retrieved September 2013, from http://www.owrb.ok.gov/supply/ocwp/pdf_ocwp/7issues&prob.pdf

Oskin, B. (2013). *Storms Aplenty, But Hurricanes Rare in Hawaii*. Retrieved February 2014, from http://www.livescience.com/38515-why-hawaii-hurricanes-rare.html

O'Steen, L., Ledbetter, R., Southern Archaeological Services, Elliott, D., & Lamar Institute. (2002, August). *Archaic Period: Overview*. Retrieved from History and Archaeology: http://www.georgiaencyclopedia.org/articles/history-archaeology/archaic-period-overview

Pacific Fishery Management Council. (2011). *Coastal Pelagic Species Fishery Management Plan as Amended Through Amendment 13.* Retrieved 2015 March, from Coastal Pelagic Species Fishery Management Plan as Amendhttp://www.pcouncil.org/wp-content/uploads/CPS_FMP_as_Amended_thru_A13_current.pdf

Pacific States Marine Fisheries Commission. (1999). *Pacific Salmon EFH.* Retrieved January 30, 2015, from Identification of Essential Fish Habitat for Pacific Salmon (Appendix A of Amendment 14 to Pacific Coast Salmon Plan): http://www.psmfc.org/efh/salmon_efh.html

Pedersen et al. (2007). *Infectious Diseases and Extinction Risk in Wild Mammals.* Retrieved June 23, 2015, from http://altizerlab.uga.edu/Publications/PDFs/Pedersen_et_al_2007.pdf

Pennsylvania Historic and Museum Commission. (Undated). *Late Woodland*. Retrieved February 14, 2017, from Pennsylvania Archaeology: http://www.phmc.state.pa.us/portal/communities/archaeology/native-american/late-woodland-period.html

Pennsylvania Historical & Museum Commission. (2013). *The Era of Industrial Ascendancy: 1861-1945*. Retrieved December 2013, from http://www.portal.state.pa.us/portal/server.pt?open=512&objID=4281&&PageID=478730&level=4&css=L4&mode=2

PHMSA. (1996). *Natural Disaster Study [National Pipeline Risk Index]*. Retrieved December 2013, from https://www.npms.phmsa.dot.gov/data/data_natdis.htm

PHMSA. (2013a). *Legislative Authority and Regulations*. Retrieved December 2013, from http://phmsa.dot.gov/pipeline/state-programs

PHMSA. (2013b). *2004-2013 Incident Map*. Retrieved December 2013, from http://www.phmsa.dot.gov/hazmat/library/data-stats/incidents

PHMSA. (Undated). *HAZMAT Intelligence Portal, Yearly Incident Summary Reports*. Retrieved December 2013, from https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Dashboard

Pioneer Technical Services, Inc. - Prepared for Montana Department of Environmental Quality. (2015). *Final Data Summary and Analysis Report - Subsidence Drilling Investigation, Red Lodge, Montana.* Retrieved October 2015, from http://www.deq.mt.gov/AbandonedMines/pdfs/ProjectDocuments/RedLodge/Red%20Lodge%20DSAR_FINAL.pdf

Pluckhahn, T. J. (2003). *Woodland Period: Overview*. Retrieved February 13, 2017, from New Georgia Encyclopedia: http://www.georgiaencyclopedia.org/articles/history-archaeology/woodland-period-overview

Pocewicz, A., Estes-Zumpf, W. A., Anderson, M. D., Copeland, H. E., & Keinath, D. A. (2013, October 2). Modeling the Distribution of Migratory Bird Stopovers to Inform Landscape-Scale Siting of Wind Development. *PLoS ONE*. Retrieved January 5, 2015, from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0075363

PRISM Climate Group. (2015). *30-Year Normals*. Retrieved January 18, 2016, from PRISM Climate Group: http://prism.oregonstate.edu/normals/

Qi, S. L., & Christenson. (2010). *Assessing Groundwater Availability in the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, FS 2010-3008.* U.S. Geological Survey. Retrieved October 2013, from http://txpub.usgs.gov/HPWA/index.html

Radbruch-Hall, D., Colton, R., Davies, W., Lucchitta, I., Skipp, B., & Varnes, D. (1982). *Landslide Overview Map of the Conterminous United States.* Retrieved December 2015, from http://pubs.usgs.gov/pp/p1183/pp1183.html

Raffaele, H. A., & Wiley, J. W. (2014). *Wildlife of the Caribbean.* Princeton: Princeton University Press. Retrieved December 2, 2015, from http://www.jstor.org/stable/j.ctt6wpz6k

Rahbek, C. (1995). *The elevational gradient of species richness: a uniform pattern?* Retrieved December 4, 2015, from Wiley Online Library: http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0587.1995.tb00341.x/epdf

Red River Basin Commission. (2011). *Long Term Flood Solutions for the Red River Basin*. Retrieved September 2013, from http://www.redriverbasincommission.org/Comprehensive_Report_12-15-11_FINAL.pdf

Reeves, W. K. (2001, December 31). Retrieved December 29, 2015, from https://www.researchgate.net/profile/Will_Reeves/publication/232667027_Invertebrate_and_slime_mold_cavernicoles_of_Santee_Cave_South_Carolina_U.S.A/links/551da9400cf2a2d9e13b0d55.pdf

Reilly, T., Dennehy, K., Alley, W., & Cunningham, W. (2008). *Ground Water Availability in the United States: U.S. Geological Survey Circular 1323.* Retrieved September 2013, from http://pubs.usgs.gov/circ/1323/

Renewable Energy Focus.com. (2013). *U.S. Energy Department invests US $16 million in tidal energy*. Retrieved September 2013, from http://www.renewableenergyfocus.com/view/34407/us-energy-department-invests-us-16-million-in-tidal-energy/

Rice, D. (2013). *Hurricane Sandy, drought cost U.S. $100 billion*. Retrieved February 2014, from http://www.usatoday.com/story/weather/2013/01/24/global-disaster-report-sandy-drought/1862201/

Rodriguez, J. M. (2014). *Groundwater Quality Monitoring Project, MJ00D7V, FY 2011-2013.* Retrieved January 2014, from http://pr.water.usgs.gov/projects/GW_quality_monitoring/

Rolfsmeier, S. B., & Steinauer, G. (2010, March 9). Retrieved January 4, 2016, from http://outdoornebraska.gov/wp-content/uploads/2015/10/PDF_C_TerrestrialEcologicalSystems_110515.pdf

Ryder, P. D. (1996). *Rio Grande Aquifer System, Oklahoma, Texas, HA730-E*. Retrieved December 2013, from http://pubs.usgs.gov/ha/ha730/ch_e/E-text2.html

Sacramento County Airport System. (2015). *Sacramento County Airport System Noise Page.* Retrieved 6 10, 2015, from http://www.sacramento.aero/scas/environment/noise/noise_101/

Sada, D. (2008). *Great Basin Riparian and Aquatic Ecosystems.* Retrieved September 2013, from http://www.fs.fed.us/rm/pubs/rmrs_gtr204/rmrs_gtr204_049_052

Saint Louis Post Dispatch. (2010). *Lead smelter in Herculaneum set to close in 2013*. Retrieved December 2013, from http://www.stltoday.com/news/local/metro/lead-smelter-in-herculaneum-set-to-close-in/article_54400025-2940-5b3f-b753-6e931e596cac.html

Sarmiento, C., & Miller, T. R. (2006). *Costs and Consequences of Flooding and the Impact of the National Flood Insurance Program.* Retrieved February 2014, from http://www.fema.gov/media-library/assets/documents/9513?id=2577

Save Our Bosque Task Force. (2004). *Conceptual Restoration Plan: Active Floodplain of the Rio Grande*. Retrieved September 2013, from http://www.emnrd.state.nm.us/SFD/districts/socorro/Vol_1_PhaseI_II_Report_Final.pdf

Schwab, J. (2011). *QuickNotes #32: Integrating Hazard Mitigation Into the Comprehensive Plan* . Chicago, IL: American Planning Association Planning Advisory Service.

Science Daily. (2009). *Impacts of Floods on Soils*. Retrieved November 2013, from http://www.sciencedaily.com/releases/2009/04/090408140204.htm

Seattle Police Department. (2009). *Seattle Police Department Annual Report.* Retrieved October 2013, from http://www.seattle.gov/police/publications/AR/AR09_secure.pdf

Serpi, T., & Baumann, P. (1996). *Module 2 -- Flood Analysis: Mississippi River Basin (Version 1).* Retrieved December 2013, from http://training.fema.gov/EMIWeb/edu/docs/techem/8baumann.doc

Shull, C. (2010, January 4). *Determination of Eligibility Notification*. Retrieved from http://achp.gov/docs/Keeper-NantucketSoundDOE.pdf

Slater, L., & Villarini, G. (2016). Recent Trends in U.S. Flood Risk. *Geophysical Research Letters*, 12,428 - 12,436.

Socioeconomic Data and Applications Center. (2011). *Global Reservoir and Dam (GRanD), v1*. Retrieved January 2014, from http://sedac.ciesin.columbia.edu/data/set/grand-v1-reservoirs-rev01/data-download

Solar Energy Industries Association. (2013). *Solar Industry Data*. Retrieved September 2013, from http://www.seia.org/research-resources/solar-industry-data

South Carolina Department of Natural Resources. (2005). *Comprehensive Wildlife Conservation Strategy.* Retrieved July 2013, from http://www.dnr.sc.gov/cwcs/overview.html

South Carolina Emergency Management Division. (2012). *South Carolina Earthquake Guide.* Retrieved November 2015, from http://scearthquakes.cofc.edu/pdf/EQGuide2012.pdf

South Carolina Emergency Management Division. (2015). *Earthquakes.* Retrieved November 2015, from http://www.scemd.org/planandprepare/disasters/earthquakes

South Florida Water Management District. (2015). *Canal and Structure Operations*. Retrieved September 2013, from http://www.sfwmd.gov/portal/page/portal/xweb%20drought%20%20and%20%20flood/canal%20and%20structure%20operations

Southwest Biological Science Center. (2015a). *Cave Ecology - Cave Ecology Introduction*. Retrieved December 31, 2015, from Colorado Plateau Research Station: http://sbsc.wr.usgs.gov/cprs/research/projects/caves/

Southwest Biological Science Center. (2015b). *Cave Ecology - Wildlife Cave Use*. Retrieved December 31, 2015, from Colorado Plateau Research Station: http://sbsc.wr.usgs.gov/cprs/research/projects/caves/wildlife.asp

Spahr, N., Apodaca, L., Deacon, J., Bails, J., Bauch, N., Smith, C., & Driver, N. (2000). *Water Quality in the Upper Colorado River Basin, Colorado, 1996–98.* Retrieved November 2013, from http://pubs.water.usgs.gov/circ1214

St. Louis Magazine. (2010). *Remember Times Beach: The Dioxin Disaster, 30 Years Later*. Retrieved December 2013, from http://www.stlmag.com/St-Louis-Magazine/December-2012/Remember-Times-Beach-The-Dioxin-Disaster-30-Years-Later/

Stanford SOLAR Center. (2008). *Bighorn Medicine Wheel*. Retrieved October 2013, from http://solar-center.stanford.edu/AO/bighorn.html

Stanford University. (Undated). *National Performance of Dams Programs*. Retrieved October 2013, from http://npdp.stanford.edu/node/63

Stark, J., Hanson, P., Goldstein, R., Fallon, J., Fong, K., Lee, A., . . . Andrews, W. (2000). *Water Quality in the Upper Mississippi River Basin, Minnesota, Wisconsin, South Dakota, Iowa, and North Dakota, 1995–98.* U.S. Geological Survey Circular 1211. Retrieved November 2013, from http://pubs.water.usgs.gov/circ1211/

State of New Jersey. (2013). *Pharmaceuticals*. Retrieved December 2013, from http://www.nj.gov/njbusiness/industry/pharmaceutical/

Steinuer, K. (2011). *Nebraska's Traditional Cultural Properties in the Section 106 Process. Lincoln: DigitalCommons@University of Nebraska - Lincoln*. Retrieved December 2013, from Masters Thesis: http://digitalcommons.unl.edu/anthrotheses/19/

Stone, R. P., & Shotwell, S. K. (2007). *State of Deep Coral Ecosystems in the Alaska Region: Gulf of Alaska, Bering Sea and the Aleutian Islands.* Retrieved January 13, 2016, from http://www.habitat.noaa.gov/pdf/pub_deep_coral_report_2007.pdf

Stoner, J., Lorenz, D., Goldstein, R., Brigham, M., & Cowdery, T. (1998). *Water Quality in the Red River of the North Basin, Minnesota, North Dakota, and South Dakota, 1992-95.* Retrieved November 2013, from http://water.usgs.gov/pubs/circ1169

Strobl, E. (2008, July). *The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties.* Retrieved from http://ftp.iza.org/dp3619.pdf

Susquehanna River Basin Commission. (2001). *Sound Flood Plain Management Practices Within Pennsylvania*. Retrieved September 2013, from http://www.srbc.net/pubinfo/docs/FPM%20Fact%20Sheet.pdf

Szirmai, A. (2009). *Is Manufacturing Still the Main Engine of Growth in Developing Countries?* Retrieved October 2013, from http://www.wider.unu.edu/publications/newsletter/articles/en_GB/05-09-Szirmai/

Takeuchi, N., Kohshima, S., & Segawa, T. (2003). Effect of cryoconite and snow algal communities on surface albedo on maritime glaciers in south Alaska. *Bulletin of Glaciological Research, 20*, 21-

27. Retrieved December 31, 2015, from http://www-es.s.chiba-u.ac.jp/~takeuchi/pdf/03bgr_Alaskam.pdf

Talley, J. (1981). *Sinkholes, Hockessin Area, Delaware.* Retrieved June 2015, from http://udspace.udel.edu/bitstream/handle/19716/3238/OFR14.pdf;jsessionid=54CE2C19BF11034644A59583286DBADE?sequence=1

Tebaldi, C., Adams-Smith, D., & Heller, N. (2012). *The Heat is On: U.S. Temperature Trends.* Retrieved October 2013, from www.climatecentral.org/wgts/heat-is-on/HeatIsOnReport.pdf

Tennessee Valley Authority. (2013). *Flood Damage Reduction*. Retrieved September 2013, from http://www.tva.com/river/flood/index.htm

Texas Coastal Management Program. (2011). *Section 309 Assessment and Strategies Report 2011-2015.* Retrieved from https://coast.noaa.gov/czm/enhancement/media/tx3092011.pdf

Thank You Delaware Bay. (2012). *What's Unique About Delaware Bay*. Retrieved October 2013, from http://www.tydb.org/a_unique.php

The Atlantic Wire. (2011). *U.S. Nuclear Facilities Threatened by Flood and Fire*. Retrieved December 2013, from http://m.theatlanticwire.com/national/2011/06/fire-and-flood-waters-threaten-us-nuclear-facilities/39281/

The Delaware Geological Survey. (2015). *Natural Hazards in Delaware.* Retrieved June 2015, from http://www.dgs.udel.edu/delaware-geology/natural-hazards-delaware

The National Committee on Levee Safety. (2011). *About Levees*. Retrieved September 2013, from Recommendations for a National Levee Safety Program: http://www.leveesafety.org/levee.cfm

The Port Authority of New York & New Jersey. (2013). *Commuting & Traveling*. Retrieved November 2013, from http://www.panynj.gov/commuting-traveling.html

The Puerto Rico Hurricane Center. (Undated). *Hurricane Hugo 1989 in Puerto Rico Report*. Retrieved October 2013, from http://huracanado1.tripod.com/hugo.html

The Wall Street Journal. (2013). *Norfolk Southern celebrates 50 years of world-class service to global coal market with Pier 6*. Retrieved September 2013, from http://online.wsj.com/article/PR-CO-20130918-907879.html

The White House (President Barack Obama). (2013). *Briefing Room*. Retrieved October 2013, from http://www.whitehouse.gov/the-press-office/2013/06/14/president-obama-signs-disaster-declaration-republic-marshall-islands

The White House (President George W. Bush). (Undated). *Hurricane Katrina - Lessons Learned, Chapter Four: A Week of Crisis (August 29 - September 5)*. Retrieved October 2013, from http://georgewbush-whitehouse.archives.gov/reports/katrina-lessons-learned/chapter4.html

The White House. (2013, November 1). *Executive Order -- Preparing the United States for the Impacts of Climate Change*. Retrieved from Executive Orders: https://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change

Toxic Free North Carolina. (Undated). *Pesticides Commonly Used on Tobacco*. Retrieved December 2013, from http://www.toxicfreenc.org/informed/pdfs/Tobacco_chems.pdf

Traweek, M., & Welch, R. (1992). *Exotics in Texas.* Retrieved June 30, 2015, from Texas Parks and Wildlife Department: http://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_w7000_0206.pdf

Tribal Energy and Environmental Information Clearinghouse. (Undated). *Coal Mining Technologies*. Retrieved September 2013, from http://teeic.anl.gov/er/coal/restech/tech/index.cfm

U.S. Army. (2013). *White Sands Missile Range*. Retrieved October 2013, from http://www.wsmr.army.mil/Pages/Home.aspx

U.S. Census Bureau. (2000a). American Fact Finder, Decennial Census Data 2000, DP-1: Summary File 1 (SF 1) 100-Percent Data. Retrieved February 2016, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_00_SF1_DP1&prodType=table

U.S. Census Bureau. (2000b). *American Fact Finder, Decennial Census Data 1990, 2000 and 2010*. Retrieved October 2013, from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. (2003). *Poverty: 1999.* Census 2000 Brief, C2KBR-19. Retrieved March 2016, from http://www.census.gov/prod/2003pubs/c2kbr-19.pdf

U.S. Census Bureau. (2010). *American Fact Finder: American Communities Survey*. Retrieved October 2013, from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Climate Change Science Program. (2008). *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States.* Retrieved July 2, 2015, from http://www.sap43.ucar.edu/documents/SAP_4.3_6.18.pdf

U.S. Commission on Ocean Policy. (2004). *An Ocean Blueprint for the 21st Century.* Retrieved October 2013, from http://govinfo.library.unt.edu/oceancommission/documents/full_color_rpt/000_ocean_full_report.pdf

U.S. Department of Agriculture. (1999). *Soil Taxonomy – A Basic System of Soil Classification for Making and Interpreting Soil Surveys*. Retrieved September 2013, from ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/tax.pdf

U.S. Department of Agriculture. (2000). *Acres of Prime Farmland, 1997 (Image)*. Retrieved September 2013, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012232.pdf

U.S. Department of Agriculture. (2010). *Soil Survey Geographic (SSURGO)*. Retrieved March 2014, from Natural Resources Conservation Service: http://goto.arcgisonline.com/maps/Specialty/Soil_Survey_Map

U.S. Department of Agriculture. (2012). *Prime and Unique Farmlands*. Retrieved October 2013, from ftp://ftp-fc.sc.egov.usda.gov/HI/pub/technical/RC_SEC_Information/SEC-PrimeandUniqueFarmlands.pdf

U.S. Department of Agriculture. (2015a, March 6). *Animal Production*. Retrieved Decemeber 17, 2015, from Producers: http://www.usda.gov/wps/portal/usda/usdahome?navid=ANIMAL_PRODUCTION

U.S. Department of Agriculture. (2015b, October 22). *National Agricultural Statistics Service Puerto Rico Field Office*. Retrieved Decemeber 2, 2015, from National Agricultural Statistics Service: http://www.nass.usda.gov/Statistics_by_State/Puerto_Rico/index.php

U.S. Department of Agriculture. (2015c, October 22). *National Agricultural Statistics Service Hawaii Field Office*. Retrieved December 2, 2015, from National Agricultural Statistics Service: http://www.nass.usda.gov/Statistics_by_State/Hawaii/index.php

U.S. Department of Agriculture. (2016). *2014 State Agriculture Overview - Nevada*. Retrieved January 4, 2016, from National Agricultural Statistics Service: http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NEVADA

U.S. Global Change Research Program. (2009). *Global Climate Change Impacts in the United States.* Retrieved October 2013, from http://nca2009.globalchange.gov/

U.S. Society on Dams. (2015). *Register of Dams*. Retrieved September 2013, from http://www.ussdams.org/uscold_s.html

U.S. Virgin Islands Department of Planning and Natural Resources. (2008). *U.S. Virgin Islands Water Quality Assessment and Report.* Retrieved December 2013, from http://www.dpnr.gov.vi/userfiles/2008%20Integrated%20Report.pdf

U.S. Virgin Islands, Division of Fish and Wildlife. (2013). *Fisheries in the U.S. Virgin Islands.* Retrieved October 2013, from http://www.fisheriesforum.org/sites/www.fisheriesforum.org/files/Brown%20-%20USVI%20Data.pdf

U.S. Water Resources Council. (1978). *The Nation's Water Resources: 1975-2000, Volume 4: Texas-Gulf Region*. Retrieved September 2013, from http://water.usgs.gov/watercensus/file/Vol_4_Texas_Gulf.pdf

Union of Concerned Scientists. (2012a). *Coal vs. Wind*. Retrieved September 2013, from http://www.ucsusa.org/clean_energy/coalvswind/c01.html

Union of Concerned Scientists. (2012b). *Environmental impacts of coal power: water use*. Retrieved September 2013, from http://www.ucsusa.org/clean_energy/coalvswind/c02b.html

University of California Integrated Pest Management Program. (2015). *Exotic and Invasive Pests in California.* Retrieved July 2, 2015, from http://www.ipm.ucdavis.edu/EXOTIC/index.html

University of Idaho. (Undated). *The Twelve Soil Orders*. Retrieved September 2013, from http://www.cals.uidaho.edu/soilorders/orders.htm

University of Michigan. (2012). *U.S. Wasterwater Treatment Fact Sheet.* Retrieved September 2013, from http://css.snre.umich.edu/css_doc/CSS04-14.pdf

University of Minnesota -- Minnesota Geological Survey. (2014). *Minnesota at a Glance.* Retrieved December 2015, from http://conservancy.umn.edu/bitstream/handle/11299/59426/mn_glance%20earthquakes_revised.pdf?sequence=7&isAllowed=y

University of Minnesota. (2001). *Soils and Landscapes of Minnesota*. Retrieved September 2013, from http://www.extension.umn.edu/distribution/cropsystems/dc2331.html

University of Minnesota. (2014). *Superior Facts*. Retrieved October 2013, from http://www.seagrant.umn.edu/superior/facts

University of Montana. (2013). *Creation and Growth of the National Wilderness Preservation System*. Retrieved from Wilderness.net: http://www.wilderness.net/index.cfm?fuse=nwps&sec=fastfacts

University of Montana. (Undated(a)). *Map of Wilderness Areas*. Retrieved October 2013, from http://www.wilderness.net/map

University of Montana. (Undated(b)). *Gila Wilderness*. Retrieved October 2013, from http://www.wilderness.net/index.cfm?fuse=NWPS&sec=wildView&wid=205

University of Nevada, Reno. (2015a). *Earthquakes.* Retrieved April 2015, from http://www.nbmg.unr.edu/Geohazards/Earthquakes/Earthquakes.html

University of Nevada, Reno. (2015b). *Subsidence*. Retrieved April 2015, from http://www.nbmg.unr.edu/Geohazards/Subsidence.html

University of Southern California. (Undated). *Tsunamis in Alaska.* Retrieved October 2013, from http://www.usc.edu/dept/tsunamis/alaska/index.html

University of Vermont. (Undated). *Vermont Mining*. Retrieved December 2013, from http://www.uvm.edu/~envprog/formslinks/Vermont%20Mining/Granite.html

University of Washington. (2015). *courses.washington.edu/archy320/Phases.doc.* Retrieved February 2017, from courses.washington.edu/archy320/Phases.doc

Upton, D. (1986). *America's Architectural Roots: Ethnic Groups that Built America.*

USA Today. (2014). *14 dead, 176 missing in Washington landslide*. Retrieved March 2014, from http://www.usatoday.com/story/news/nation/2014/03/24/washington-mudslide/6823195/

USACE. (1987, January). *Corps of Engineers Wetlands Delineation Manual.* Retrieved from Environmental Laboratory: http://www.ecy.wa.gov/programs/sea/wetlands/pdf/corps87manual.pdf

USACE. (2009a). *Ohio River Basin Comprehensive Reconnaissance Report.* Retrieved September 2013, from http://www.lrp.usace.army.mil/Missions/Planning,ProgramsProjectManagement/KeyProjects/MonongahelaRiverWatershedAssessment.aspx

USACE. (2009b). *Deep Water Ports and Harbors.* Retrieved October 2013, from http://www.corpsresults.us/docs/navigation/VTNDeepPortsHarborsBro_lores.pdf

USACE. (2011a). *National Levee Database: Levee Centerlines*. Retrieved January 2014, from Levee Centerlines.

USACE. (2011b). *National Levee Database: Leveed Area*. Retrieved January 2014, from Leveed Area.

USACE. (2013). *National Levee Database*. Retrieved September 2013, from http://www.usace.army.mil/Missions/CivilWorks/LeveeSafetyProgram/NationalLeveeDatabase.aspx

USACE. (2015). *Atlantic Intracoastal Waterway*. Retrieved October 2013, from http://www.nao.usace.army.mil/Missions/CivilWorks/AIWW.aspx

USACE. (Undated(a)). *National Inventory of Dams*. Retrieved from CorpsMap: http://geo.usace.army.mil/pgis/f?p=397:5:0::NO

USACE. (Undated(b)). *Inland Waterway Navigation - Value to the Nation*. Retrieved September 2013, from http://www.sas.usace.army.mil/Portals/61/docs/lakes/thurmond/navigate.pdf

USCB. (2012a). *Current Population Survey - Definitions*. Retrieved October 2013, from http://www.census.gov/cps/about/cpsdef.html

USCB. (2012c). *American Fact Finder: American Community Survey 2012 5-Year Estimates, Table DP03*. Retrieved February 2014, from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

USCB. (2013b). *Topologically Integrated Geographic Encoding and Referencing*. Retrieved October 2013, from http://www.census.gov/geo/maps-data/data/tiger-line.html

USCB. (2014). *American Fact Finder - 2010 Census Summary File 1, Table QT-P6*. Retrieved January 2014, from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

USCB. (Undated). *Community Facts: ACS Demographic and Housing Estimates 2011-2015*. Retrieved February 14, 2017, from American Fact Finder: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

USFS. (2005). *Rapid Assessment Reference Condition Model: Great Lakes Floodplain Forest*. Retrieved September 2013, from http://www.fs.fed.us/database/feis/pdfs/PNVGs/Great_Lakes/R6FPFOgl.pdf

USFS. (2011). *Upper Mississippi River Forestry Partnership Action Strategy, 2005-2010.* Retrieved November 2013, from http://www.na.fs.fed.us/watershed/upper_mississippi_partnership/

USFS. (2012). *Land Areas of the National Forest System.* Retrieved October 2013, from http://www.fs.fed.us/land/staff/lar/LAR2011/LAR2011_Book_A5.pdf

USFS. (2014, April 29). *Indicator 1.01: Area and Percent of Forest by Type*. Retrieved from Forest Sustainability Reporting in the United States: http://www.fs.fed.us/research/sustain/criteria-indicators/indicators/indicator-101.php

USFWS & NOAA Fisheries. (1998). *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act, Final.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/laws/esa_section7_handbook.pdf

USFWS. (1984). *Mona Boa Recovery Plan.* Recovery Plan, Atlanta, GA. Retrieved December 16, 2014, from http://ecos.fws.gov/docs/recovery_plan/840419a.pdf

USFWS. (1987, June). *Mid-Atlantic Wetlands, A Disappearing Natural Treasure.* Retrieved January 24, 2016, from http://www.fws.gov/wetlands/Documents/Mid-Atlantic-Wetlands-A-Disappearing-Natural-Treasure.pdf

USFWS. (1988). *The Ecology of the Lower Colorado River from Davis Dam to the Mexico-United States International Boundary: A Community Profile*. Retrieved September 2013, from www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA323043&Location=U2

USFWS. (1998). *Recovery Plan for the Insect and Plant Taxa for the Santa Cruz Mountains in California.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/980928a.pdf

USFWS. (1999). *Important Facts about Habitat Loss and Birds.* Retrieved June 23, 2015, from http://digitalmedia.fws.gov/cdm/ref/collection/document/id/272

USFWS. (2000, January 14). *Two Hawaiian Cave Animals Added to Endangered Species List.* Retrieved December 17, 2015, from Pacific Islands Ecoregion External Affairs Office: http://www.fws.gov/pacific/news/2000/2000-pie08.htm

USFWS. (2001). *Florida Manatee Recovery Plan.* Retrieved February 10, 2015, from http://ecos.fws.gov/docs/recovery_plan/011030.pdf

USFWS. (2002). *Yukon Delta National Wildlife Refuge.* Retrieved from http://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_1/Yukon_Delta/PDF/yukondelta.pdf

USFWS. (2006). *The Coastal Program Stewardship of Fish and Wildlife Through Voluntary Conservation, Regional Step-Down Plan Region 2 (Texas), Part 2 of 3, FY 2006-2010.* Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjJ3tP0k7vKAhXEVh4KHWJqAnYQFggcMAA&url=https%3A%2F%2Fwww.fws.gov%2Fcoastal%2FRegions%2F8_6_07_Final_Draft_Coastal_Step_Down_plan.pdf&usg=AFQjCNFyKptRZH6Ydzu7UlKSM-cwn

USFWS. (2007a). *The Coastal Program, Strategic Plan, Stewardship of Fish and Wildlife Through Voluntary Conservation, Regional Step-Down Plan Region 3 - "Great Lakes -Big Rivers" Part 2 of 3, FY 2007-2011.* Retrieved from http://www.fws.gov/coastal/Regions/May_04_2007_Final_R3_GLCP_STP.pdf

USFWS. (2007b). *Recovery Plan for the Sierra Nevada Bighorn Sheep.* Sacramento, CA. Retrieved December 2014, from http://ecos.fws.gov/docs/recovery_plan/080213_1.pdf

USFWS. (2012a, September 20). *Mariana Swiftlet / Aerodramus bartschi / Chachaguak.* Retrieved December 17, 2015, from Endangered Species in the Pacific Islands: http://www.fws.gov/pacificislands/fauna/marianaswiflet.html

USFWS. (2012b, September 20). *Endangered Species in the Pacific Islands, Hawaiian Goose/Branta sandvicensis/Nene*. Retrieved December 2, 2015, from Pacific Islands Fish and Wildlife Office: http://www.fws.gov/pacificislands/fauna/HIgoose.html

USFWS. (2012c). *Frequently Asked Questions About Invasive Species*. Retrieved June 2015, from http://www.fws.gov/invasives/faq.html#q3

USFWS. (2012d). *Consequences for Wildlife*. Retrieved June 2015, from Conservation in a Changing Climate: http://www.fws.gov/home/climatechange/impacts.html

USFWS. (2013a, September 19). *Wildlife and Habitat: Guam National Wildlife Refuge*. Retrieved December 2, 2015, from http://www.fws.gov/refuge/Guam/wildlife_and_habitat/

USFWS. (2013b). *Integrating the Service's Mission with Agriculture in Kentucky*. Retrieved from http://ky.water.usgs.gov/projects/ky_ag_monitoring_committee/KASMC_present_jul2013/usfws_ky_ag.pdf

USFWS. (2013c). *List of Migratory Bird Species Protected by the Migratory Bird Treaty Act as of December 2, 2013.* Retrieved December 2013, from http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/MBTANDX.HTML

USFWS. (2013d). *What is critical habitat?* Retrieved December 2013, from http://www.fws.gov/endangered/what-we-do/critical-habitats-faq.html

USFWS. (2013e). *USA National Wild and Scenic Rivers*. Retrieved from www.rivers.gov

USFWS. (2014, December 2). *Caribbean Freshwater Crustaceans.* Retrieved December 16, 2015, from National Conservation Training Center: http://nctc.fws.gov/Pubs4/carib_crustaceans.pdf

USFWS. (2015a, June 8). *Coastal Barrier Resources Act*. Retrieved from Coastal Barrier Resources System: https://www.fws.gov/ecological-services/habitat-conservation/cbra/Act/index.html

USFWS. (2015b, May). *National Wildlife Refuge Alaska Region*. Retrieved from https://www.fws.gov/alaska/nwr/map.htm

USFWS. (2015c, November 17). *Wildlife and Habitat: Vieques National Wildlife Refuge Puerto Rico*. Retrieved Decemeber 16, 2015, from http://www.fws.gov/refuge/Vieques/wildlife_and_habitat/index.html

USFWS. (2015d, February 6). *Wildlife and Habitat: Hawaiian Islands National Wildlife Refuge Hawaii*. Retrieved December 16, 2015, from http://www.fws.gov/refuge/Hawaiian_Islands/wildlife_and_habitat/

USFWS. (2015e, March 11). *Habitat: Cape Meares National Wildlife Refuge*. Retrieved January 3, 2016, from http://www.fws.gov/refuge/Cape_Meares/wildlife_and_habitat/habitat.html

USFWS. (2015f, September 28). *Wildlife & Habitat: Upper Mississippi River*. Retrieved December 2, 2015, from http://www.fws.gov/refuge/Upper_Mississippi_River/wildlife_and_habitat/index.html

USFWS. (2015g). *Species Proposed for Listing.* Retrieved April 31, 2015, from http://ecos.fws.gov/tess_public/reports/ad-hoc-species-report?status=P&header=Species+Proposed+for+Listing&fleadreg=on&fstatus=on&finvpop=on

USFWS. (2015h). *Coastal Barrier Resources Act*. Retrieved December 2016, from https://www.fws.gov/ecological-services/habitat-conservation/cbra/Act/index.html

USFWS. (2016, January 21). *Coastal Salt Marsh.* Retrieved January 24, 2016, from Multi-Species Recovery Plan for South Florida: https://www.fws.gov/verobeach/MSRPPDFs/SaltMarsh.pdf

USFWS Migratory Bird Program. (2015, September 1). *Flyways*. Retrieved January 11, 2016, from http://www.fws.gov/birds/management/flyways.php

USFWS Pacific Southwest Region. (2013, April 12). *Threatened, Endangered and Candidate Species*. Retrieved from http://www.fws.gov/yreka/endangeredspecies.html

USFWS. (Undated(a)). *Caribbean: Puerto Rico and U.S. Virgin Islands*. Retrieved September 2013, from http://www.fws.gov/southeast/es/partners/statefactsheets/caribbean_longv.pdf

USFWS. (Undated(b)). *ECOS Environmental Conservation Online System*. Retrieved January 18, 2016, from http://ecos.fws.gov/ecp/

USFWS Witchita Mountains Wildlife Refuge. (2014, September 18). *American Bison*. Retrieved from American Bison: http://www.fws.gov/refuge/Wichita_Mountains/American_bison.html

USFWS, Pennsylvania Field Office. (2001). *Bog Turtle, Northern Population.* Recovery Plan, State College, PA. Retrieved October 2014, from http://ecos.fws.gov/docs/recovery_plan/010515.pdf

USGS - University of California Davis. (2007). *Hawaiian Duck's Future Threatened by Feral Mallards.* Retrieved January 2017, from https://pubs.usgs.gov/fs/2007/3047/fs2007-3047.pdf

USGS. (1968). Retrieved January 18, 2016, from https://store.usgs.gov/b2c_usgs/catalog/setCurrentItem/(isQuery=yes&xcm=r3standardpitrex_prd&layout=7_1_94_62_2&uiarea=2&itemPageSize=100&next=seeItem&carea=0000000003&citem=00000001650000000026)/.do

USGS. (1984). *Changes in Flood Response of the Red River of the North Basin, North Dakota-Minnesota (Water Supply Paper 2243)*. Retrieved September 2013, from http://pubs.usgs.gov/wsp/2243/report.pdf

USGS. (1993). *National Water Summary 1990-91: Hydrologic Events and Stream Water Quality*. Retrieved September 2013, from http://pubs.usgs.gov/wsp/2400/report.pdf

USGS. (1994). *Saltwater Intrusion and Quality of Water in the Floridan Aquifer System, Northeastern Florida.* Retrieved April 2014, from Water-Resources Investigations Report 92-4174: http://fl.water.usgs.gov/PDF_files/wri92_4174_spechler.pdf

USGS. (1995). *Groundwater Atlas of the United States -- Arizona, Colorado, New Mexico, Utah.* Retrieved November 2015, from http://pubs.usgs.gov/ha/ha730/ch_c/C-text1.html

USGS. (1996a). *Debris-flow Hazards in the Blue Ridge of Virginia (Fact Sheet 159-96)*. Retrieved September 2013, from http://landslides.usgs.gov/docs/faq/fs159-96.pdf

USGS. (1996b). *United States Geological Survey Water-supply Paper.* Retrieved December 18, 2015, from https://books.google.com/books?id=UDU411JLwI8C&pg=PA371&lpg=PA371&dq=US+virgin+islands+subtropical+wetlands&source=bl&ots=wa6YiHkn5A&sig=RQiwawuMr4G0i9qGYiKggFWHDMc&hl=en&sa=X&ved=0ahUKEwia9f7vgebJAhVS7GMKHTKxD9AQ6AEIIzAB#v=onepage&q=US%20virgin%20islands

USGS. (1997a). *Debris-flow Hazards in Areas Affected by the June 27, 1995 Storm in Madison County, Virginia*. Retrieved September 2013, from http://web.wm.edu/geology/virginia/madison/?svr=www

USGS. (1997b, October 29). *Desert Features*. Retrieved January 3, 2016, from USGS: http://pubs.usgs.gov/gip/deserts/features/

USGS. (1998). *Status and Trends of the Nation's Biological Resources.* Retrieved January 16, 2016, from National Wetlands Research Center: http://www.nwrc.usgs.gov/sandt

USGS. (1999a). *How Ground Water Occurs*. Retrieved December 2013, from http://pubs.usgs.gov/gip/gw/how_a.html

USGS. (1999b, January 21). *Volcano Watch.* Retrieved January 15, 2016, from From Lava Flow to Forest: Primary Succession: http://hvo.wr.usgs.gov/volcanowatch/archive/1999/99_01_21.html

USGS. (2000). *Land Subsidence in the United States (Fact Sheet 165-00)*. Retrieved September 2013, from http://water.usgs.gov/ogw/pubs/fs00165/SubsidenceFS.v7.PDF

USGS. (2001a). *Floods and Flood Plains (Open-File Report 93-641)*. Retrieved September 2013, from http://pubs.usgs.gov/of/1993/ofr93-641/

USGS. (2001b). *Tennessee River Basin Study*. Retrieved October 2013, from http://tn.water.usgs.gov/lten/tenn.html

USGS. (2002). *General Reference.* Retrieved January 18, 2016, from https://store.usgs.gov/b2c_usgs/catalog/setCurrentItem/(isQuery=yes&xcm=r3standardpitrex_prd&layout=7_1_94_58&uiarea=2&next=seeItem&carea=0000000003&citem=00000032240000000002)/.do

USGS. (2003a). *National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction*. Retrieved September 2013, from http://pubs.usgs.gov/circ/c1244/c1244.pdf

USGS. (2003b). *A Tapestry of Time and Terrain: The Union of Two Maps, Geology and Topography*. Retrieved September 2013, from http://tapestry.usgs.gov/physiogr/physio.html

USGS. (2003c). *What is a Principal Aquifer?* Retrieved January 5, 2016, from Water Quality Assessments of Principal Aquifers: http://water.usgs.gov/nawqa/studies/praq/

USGS. (2003d). *Surface Water in Hawaii.* Retrieved September 2013, from http://pubs.usgs.gov/fs/fs04503/pdf/fs045-03.pdf

USGS. (2004). *Digital Engineering Aspects of Karst Map.* Retrieved October 2015, from http://pubs.usgs.gov/of/2004/1352/data/USA_karst.pdf

USGS. (2005). *Steam Explosions, Earthquakes, and Volcanic Eruptions -- What's in Yellowstone's Future.* Retrieved October 2015, from http://pubs.usgs.gov/fs/2005/3024/fs2005-3024.pdf

USGS. (2007a). *Managing Coastal Subsidence – Houston-Galveston, Texas*. Retrieved September 2013, from http://pubs.usgs.gov/circ/circ1182/pdf/07Houston.pdf

USGS. (2007b). *Facing Tomorrow's Challenges - U.S. Geological Survey Science in the Decade 2007-2017.* Retrieved July 1, 2015, from http://pubs.usgs.gov/circ/2007/1309/pdf/C1309.pdf

USGS. (2009a). *Landslide Hazard Program – Landslide Images*. Retrieved September 2013, from http://landslides.usgs.gov/learning/imagepreviews.php

USGS. (2009b). *Earthquake Hazard in the New Madrid Fault Zone Remains a Concern*. Retrieved September 2013, from http://pubs.usgs.gov/fs/2009/3071/pdf/FS09-3071.pdf

USGS. (2009c). *Quality of Surface Water in Missouri, Water Year 2007.* Retrieved from http://pubs.usgs.gov/of/2009/1096/pdf/OF2009_1096.pdf

USGS. (2010). *2009 Earthquake Probability Mapping*. Retrieved September 2013, from https://geohazards.usgs.gov/eqprob/2009/index.php

USGS. (2011a, November 6). *USGS Significant Earthquake Archive – Oklahoma*. Retrieved September 2013, from http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/usb0006klz/

USGS. (2011b). *Regional Assessment of Groundwater Quality in the Floridan, Biscayne, and Surficial Aquifer Systems*. Retrieved from http://water.usgs.gov/nawqa/studies/praq/flordn/index.html

USGS. (2011c). *National Gap Analysis Program (GAP) Land Cover Data Portal*. Retrieved March 16, 2015, from http://gapanalysis.usgs.gov/gaplandcover/data/

USGS. (2012a). *Effects of Urban Development on Stream Ecosystems in Nine Metropolitan Study Areas Across the United States (Circular 1373).* Retrieved August 2014, from http://pubs.usgs.gov/circ/1373/pdf/Circular1373.pdf

USGS. (2012b). *Historic Earthquakes: Charleston, SC – 1886 September 01*. Retrieved September 2013, from http://earthquake.usgs.gov/earthquakes/states/events/1886_09_01.php

USGS. (2012c). *Historic Earthquakes -- New Madrid 1811-1812 Earthquakes.* Retrieved October 2015, from http://earthquake.usgs.gov/earthquakes/states/events/1811-1812.php

USGS. (2012d). *USGS Earthquake Hazards Program – Intermountain West Region*. Retrieved September 2013, from http://earthquake.usgs.gov/regional/imw/

USGS. (2012e). *Historic Earthquakes -- Pleasant Valley, NV.* Retrieved April 2015, from http://earthquake.usgs.gov/earthquakes/states/events/1915_10_03.php

USGS. (2012f). *USGS Earthquake Hazards Program – Top Earthquake States*. Retrieved September 2013, from http://earthquake.usgs.gov/earthquakes/states/top_states.php

USGS. (2012g). *USGS California Water Science Center – Delta-Mendota Canal: Evaluation of Groundwater Conditions and Land Subsidence*. Retrieved September 2013, from http://ca.water.usgs.gov/projects/central-valley/delta-mendota-canal.html

USGS. (2012h, December). *The USGS Land Cover Institute (LCI).* Retrieved November 18, 2015, from NLCD 92 Land Cover Class Definitions: http://landcover.usgs.gov/classes.php/downloadfile.php?file=NLCD92_Colour_Classification_FINAL.jpg

USGS. (2013a). *Physiographic Divisions of the Conterminous United States*. Retrieved September 2013, from http://water.usgs.gov/GIS/metadata/usgswrd/XML/physio.xml#stdorder

USGS. (2013b). *National Land Cover Database 2006: Product Legend*. Retrieved October 2013, from http://www.mrlc.gov/nlcd06_leg.php

USGS. (2013c). *Land Subsidence from Ground-water Pumping*. Retrieved September 2013, from http://geochange.er.usgs.gov/sw/changes/anthropogenic/subside/

USGS. (2013d). *Land Subsidence*. Retrieved September 2013, from http://ga.water.usgs.gov/edu/earthgwlandsubside.html

USGS. (2013e). *USGS Ground Water Use*. Retrieved October 2013, from http://ga.water.usgs.gov/edu/wugw.html

USGS. (2013f). *Hydrologic Unit Map*. Retrieved September 2013, from http://water.usgs.gov/GIS/regions.html

USGS. (2013g). *Regional Assessment of Groundwater Quality in the Basin and Range, Rio Grande Coastal Basins, and Central Valley Aquifer Systems of the Southwestern United States*. Retrieved October 2013, from http://water.usgs.gov/nawqa/studies/praq/swpa/index.html

USGS. (2013h). *Regional Assessment of Groundwater Quality in Principal Volcanic Aquifers of the Western United States*. Retrieved October 2013, from http://water.usgs.gov/nawqa/studies/praq/wevo/index.html

USGS. (2013i). *Physiographic Regions*. Retrieved September 2013, from http://nationalatlas.gov/tapestry/physiogr/physio.html

USGS. (2013j). *Multi-Resolution Land Characteristics Consortium Viewer*. Retrieved October 2013, from http://www.mrlc.gov/viewerjs/

USGS. (2014a). *Landslide Events (July 2014).* Retrieved August 2014, from http://landslides.usgs.gov/recent/index.php?year=2014&month=Jul

USGS. (2014b). *Landslides in Washington State*. Retrieved August 2014, from http://www.usgs.gov/blogs/features/usgs_top_story/landslide-in-washington-state/

USGS. (2014c). *Effects of Urban Development on Floods (Fact Sheet 076-03).* Retrieved August 2014, from http://pubs.usgs.gov/fs/fs07603/

USGS. (2014d). *Geologic Provinces of the United States: Laurentian Upland Province - Superior Upland*. Retrieved October 2015, from http://geomaps.wr.usgs.gov/parks/province/laurent.html

USGS. (2014e). *Geologic Provinces of the United States - Interior Plain Province.* Retrieved October 2015, from http://geomaps.wr.usgs.gov/parks/province/intplain.html

USGS. (2014f). *Geologic Provinces of the United States: Ouachita-Ozark Interior Highlands*. Retrieved November 2015, from http://geomaps.wr.usgs.gov/parks/province/inthigh.html

USGS. (2014g). *Geologic Provinces of the United States: Basin and Range Province*. Retrieved October 2015, from http://geomaps.wr.usgs.gov/parks/province/basinrange.html

USGS. (2014h). *Historic Earthquakes -- Near Kosmo, Utah*. Retrieved October 2015, from http://earthquake.usgs.gov/earthquakes/states/events/1934_03_12.php

USGS. (2014i). *Seismicity Map -- 1973 to March 2012.* Retrieved April 2015, from http://earthquake.usgs.gov/earthquakes/states/nevada/seismicity.php

USGS. (2014j). *Earthquake Facts.* Retrieved December 2015, from http://earthquake.usgs.gov/learn/facts.php

USGS. (2014k). *Historic Earthquakes California*. Retrieved December 2014, from http://earthquake.usgs.gov/earthquakes/states/events/1857_01_09.php

USGS. (2014l). *Groundwater Levels for the Nation*. Retrieved March 2014, from http://nwis.waterdata.usgs.gov/nwis/gwlevels?site_no=465312096543301&agency_cd=USGS&format=html

USGS. (2015a). *M5.8 August 23, 2011 Mineral, Virginia.* Retrieved May 2015, from http://earthquake.usgs.gov/earthquakes/events/2011virginia/

USGS. (2015b). *Scientific Overview of the M5.8 Earthquake in Central Virginia on August 23, 2011.* Retrieved May 2015, from http://earthquake.usgs.gov/earthquakes/events/2011virginia/overview.php

USGS. (2015c). *Geologic Glossary*. Retrieved November 2015, from http://geomaps.wr.usgs.gov/parks/misc/glossarya.html

USGS. (2015d, December 2). *Aquifers and Groundwater*. Retrieved January 5, 2016, from http://water.usgs.gov/edu/earthgwaquifer.html

USGS. (Undated). *Significant Landslide Events in the United States*. Retrieved September 2013, from http://landslides.usgs.gov/docs/faq/significantls_508.pdf

Utah Department of Public Safety. (2011). *Flooding*. Retrieved October 2013, from http://publicsafety.utah.gov/emergencymanagement/documents/FloodMarch2011.pdf

Utah Geological Survey. (1997). *Earthquakes & Utah*. Retrieved October 2015, from http://files.geology.utah.gov/online/pdf/pi-48.pdf

Valdez, R., & Nelson, P. (2006). *Upper Colorado River Subbasin Floodplain Management Plan.* Retrieved September 2013, from http://www.coloradoriverrecovery.org/documents-publications/technical-reports/hab/ColoRiv-FMP-2-27-06.pdf

Vance, L., & Luna, T. (2010, January 17). *Great Plains Badlands*. Retrieved January 4, 2016, from Montana Field Guide: http://fieldguide.mt.gov/displayES_Detail.aspx?ES=3114

Vermont Agency of Natural Resources. (2012). *Tropical Storm Irene By the Numbers.* Retrieved February 2014, from http://www.anr.state.vt.us/anr/climatechange/irenebythenumbers.html

Viereck, L., Dyrness, C., Batten, A., & Wenzlick, K. (1992). *The Alaska Vegetation Classification.* Retrieved December 18, 2015, from http://www.fs.fed.us/pnw/publications/pnw_gtr286/pnw_gtr286a.pdf

Virginia Department of Game and Inland Fisheries. (2016). *Wildlife Information.* Retrieved January 24, 2016, from http://www.dgif.virginia.gov/wildlife/

Virginia Department of Historic Resources. (undated). *First People: The Early Indians of Virginia*. Retrieved September 5, 2017, from http://www.dhr.virginia.gov/arch_net/timeline/early_archaic.htm

Virginia Institute of Marine Science. (2010). *Chesapeake Bay Land Subsidence and Sea Level Change*. Retrieved September 2013, from http://web.vims.edu/GreyLit/VIMS/sramsoe425.pdf

Virginia Places. (Undated). *Woodland Indians in Virginia*. Retrieved February 14, 2017, from http://www.virginiaplaces.org/nativeamerican/woodlandindians.html

Wahl, T., Jain, S., Bender, J., Meyers, S., & Luther, M. (2015). *Increasing risk of compound flooding from storm surge and rainfall for major US cities.* Retrieved from http://www.nature.com/nclimate/journal/v5/n12/full/nclimate2736.html

Wald, M. (2008). *Wind Energy Bumps Into Power Grid's Limits*. Retrieved November 2013, from http://www.nytimes.com/2008/08/27/business/27grid.html?_r=3&ref=business&oref=slogin&

Wallace, A. F. (1993). *The Long, Bitter Trail: Andre Jackson and the Indians.* New York: Hill and Wang. Retrieved March 2013

Washington Department of Fish and Wildlife. (2016). *North Pacific Coastal Cliffs and Bluffs*. Retrieved January 3, 2016, from Washington Department of Fish and Wildlife: http://wdfw.wa.gov/conservation/research/ecofacts/n_pacific_coastal_cliffs_bluffs.html

Washington State Department of Ecology. (2007). *Living with the River: A Guide to Understanding Western Washington Rivers and Protecting Yourself from Floods*. Retrieved September 2013, from https://fortress.wa.gov/ecy/publications/publications/0706016.pdf

Washington State Department of Ecology. (2016). *Saving Puget Sound*. Retrieved January 12, 2016, from http://www.ecy.wa.gov/puget_sound/overview.html

Washington State Department of Transportation. (2013). *Schedule Information - By Route*. Retrieved September 2013, from http://www.wsdot.com/ferries/schedule/Default.aspx

Weary, D. J., & Doctor, D. H. (2014). *Karst in the United States: A Digital Map Compilation and Database.* Open-File Report 2014–1156. Retrieved January 18, 2016, from http://pubs.usgs.gov/of/2014/1156/

Weather.com. (2012). *Storm Encyclopedia.* Retrieved October 2013, from http://www.weather.com/encyclopedia/winter/noreast.html

Weather.com. (2013). *Fargo: Top Five Flood Ahead*. Retrieved October 2013, from http://www.weather.com/sports-rec/march-madness/red-river-fargo-top-five-flood-risk

Welch, C. (2013a). *U.S. Oil and Gas Pipelines*. Retrieved September 2013, from http://www.earthlyissues.com/usoil.htm

Welch, C. (2013b). *U.S. Power Grid*. Retrieved September 2013, from http://www.earthlyissues.com/uspower.htm

West Virginia Department of Homeland Security and Emergency Management. (Undated(a)). *Winter Floods*. Retrieved September 2013, from http://www.dhsem.wv.gov/mitigation/floodplain/Documents/Winter%20Floods.pdf

West, F., & Foster, S. (Undated). *Pacific Islands: Early Period*. Retrieved February 13, 2017, from Encyclopedia Britannica: https://www.britannica.com/place/Pacific-Islands#toc279713

Will Chee Planning & Environmental. (2014). *Final Historic Context Report: Pearl Harbor National Historic Landmark.* Honolulu.

Willey, G., & Phillips, P. (1976). *Method and Theory in American Archaeology.* Chicago and London: The University of Chicago Press.

Williams, M. (2007). *Native Plants for Coastal Dune Restoration: What, When, and How for Florida.* Retrieved December 29, 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_014913.pdf

World Nuclear Association. (2013). *Nuclear Power in the USA*. Retrieved September 2013, from http://www.world-nuclear.org/info/Country-Profiles/Countries-T-Z/USA--Nuclear-Power/

Wright, J. (2008). *Chapter 8: Floodplain Natural Resources and Functions.* Retrieved September 2013, from https://training.fema.gov/hiedu/docs/fmc/chapter%208%20-%20floodplain%20natural%20resources%20and%20functions.pdf

Wyoming State Geological Survey. (2015c). *Earthquakes*. Retrieved October 2015, from http://www.wsgs.wyo.gov/hazards/earthquakes

Page Intentionally Left Blank.

Table of Contents

List of Tables

Abbreviations and Acronyms

ACRONYM	DEFINITION
AIR	American Institutes of Research
B	Billion
BFE	Base Flood Elevation
BLM	Bureau of Land Management
BMP	Best Management Practice
BW-12	Biggert-Waters Flood Insurance Reform Act of 2012
CACs	Community Assistance Contacts
CAVs	Community Assistance Visits
CBRS	Coastal Barrier Resources System
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
CRS	Community Rating System
CWA	Clean Water Act
dBA	A-weighted decibel
DoD	Department of Defense
DOT	Department of Transportation
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAO	Government Accountability Office
GHG	Greenhouse gas
GSA	General Services Administration
HFIAA	Homeowner's Flood Insurance Affordability Act of 2014
HUD	Housing and Urban Development
LAA	Likely to Adversely Affect
LOMC	Letter of Map Change
LPR	Land Price Reductions
M	Million
MBTA	Migratory Bird Treaty Act

MSA	Magnuson- Stevens Act
NEPA	National Environmental Policy Act of 1969
NFIA	National Flood Insurance Act of 1968
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPEIS	Nationwide Programmatic Environmental Impact Statement
NPS	National Park Service
NSFHA	Non-Special Flood Hazard Area
PIF	Policy In Force
Risk MAP	Risk Mapping, Assessment, and Planning
SFHA	Special Flood Hazard Area
TFIA	The Flood Insurance Agency
TRI	Toxics Release Inventory
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WYO	Write-Your-Own

4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter analyzes the potential environmental and socioeconomic impacts—positive or negative—that could occur as a result of implementing the changes to the National Flood Insurance Program (NFIP). Because this is a programmatic evaluation, site- and species-specific issues associated with individual projects or the effects of the Preferred Alternative when combined with future actions that may be taken by other Federal agencies are not assessed in detail. The scope of the analysis is commensurate with the detail of the alternatives and the availability of data, and is at a programmatic level.[1] The existing environment, as described in Chapter 3, provides the baseline for assessing impacts.

For the purpose of this analysis, the remainder of this chapter is divided into four sections. Section 4.2 discusses resource areas with no impacts as a result of the implementation of any of the alternatives. Section 4.3 discusses resource areas with potential for impacts as a result of implementation of the alternatives. Section 4.4 compares the environmental effects of alternatives. Section 4.5 discusses the cumulative impacts of the preferred alternative. In the event of any subsequent tiering analyses under the National Environmental Policy Act (NEPA), these impacts determinations would be applied to the tiered document.

This Final Nationwide Programmatic Environmental Impact Statement (NPEIS) identifies the range of possible impacts from the following alternatives (as described in Section 2.3 and Section 2.4):

- Alternative 1 (No Action)
  - The No Action Alternative refers to the current implementation of the NFIP as described in Section 1.3. The No Action Alternative is prescribed by Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [C.F.R.] § 1502.14(d)) and serves as a benchmark against which impacts of the alternatives can be evaluated.
- Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and Letter of Map Change [LOMC] Clarification) (Preferred Alternative)
  - The changes included under Alternative 2 are:
    a) Phase out of subsidies on certain pre-Flood Insurance Rate Map (FIRM) properties (non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property) at a rate of 25 percent premium increases per year.

[1] The NFIP is a national program; therefore, impacts are expected to be similar across the FEMA regions.

b) Phase out of subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.
c) Implement a monthly installment plan payment option for non-escrowed flood insurance policies.[2]
d) Clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the Endangered Species Act (ESA), as a condition of issuing permits to develop in the floodplain.
e) Clarify that the issuing of certain LOMC requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA.

- Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

  – The changes included as part of Alternative 3 are:

a) Phase out of subsidies on certain pre-FIRM properties (non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property) at a rate of 25 percent premium increases per year.
b) Phase out of subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.
c) Implement a monthly installment plan payment option for non-escrowed flood insurance policies.[3]
d) Establish a new ESA-related performance standard in the minimum floodplain management criteria at 44 C.F.R. § 60.3 that would require communities to obtain and maintain documentation that any adverse impacts caused by proposed development, including fill, to ESA-listed species and designated critical habitat will be mitigated to the maximum extent possible.
e) Increase the probation surcharge applicable to NFIP communities placed on probation from $50 to $100.
f) Clarify that the exception to the no-rise performance standard in the floodway applies only to projects that serve a public purpose or result in the restoration of the natural and beneficial functions of floodplains.
g) Clarify that the issuance of certain LOMC requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA.

[2] Although FEMA has not worked out all the details of how this proposed modification would be implemented, use of the installment plan payment option would require the policyholder to pay an installment plan service fee, which is consistent with standard industry practice.
[3] Ibid.

- Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)
  - The changes included under Alternative 4 are:
    a) Phase out of subsidies on certain pre-FIRM properties (non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property) at a rate of 25 percent premium increases per year.
    b) Phase out of subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.
    c) Implement a monthly installment plan payment option for non-escrowed flood insurance policies.[4]
    d) Utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that the proposed development in the floodplain will be undertaken in compliance with the ESA.
    e) Clarify that the issuance of certain LOMC requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA.

The analysis in this NPEIS presents the potential direct and indirect impacts each alternative would have on the affected environment described in Chapter 3. According to 40 C.F.R. § 1508.8, "(a) Direct effects are caused by the action and occur at the same time and place. (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

Quantitative and qualitative analyses have been used in this Final NPEIS, where possible, in determining the intensity and magnitude of the environmental impact. The Federal Emergency Management Agency (FEMA) determined whether particular impacts were less than significant or significant. Impacts may be both beneficial and adverse as defined in CEQ Regulations (40 C.F.R. § 1508.27). The following terms are used in this Final NPEIS to indicate the relative degree of severity of environmental impacts:

- **No Impact:** No environmental impacts are readily apparent or identified. The resources would not be affected, or changes or benefits would be either non-detectable or, if detected, would have effects that would be minimal[5] and local. Impacts would be well below regulatory standards, as applicable.

[4] Ibid.
[5] Minimal is defined as the least possible measurable amount.

- **Less than Significant:** Indicates that a change to resources would be measurable although the changes would be limited and localized. Impacts or benefits would be within or below regulatory standards, as applicable. Mitigation measures, such as employing best management practices (BMPs) or precautionary measures, would reduce any potential adverse impacts.
- **Significant:** Changes to resources would be measurable and would have substantial consequences on a local or regional level. Impacts could exceed regulatory standards, if applicable. Mitigation measures to offset the adverse impacts would be required to reduce impacts through long-term changes to the resource.

4.1.1 The NFIP and Floodplain Development

The following text describes the relationship between the NFIP and floodplain development as it is currently implemented. All alternatives will continue to implement the NFIP in addition to certain program modifications, and thus the following material has bearing on the impacts analysis for all the alternatives. The topic of floodplain development broadly applies to many of the resource categories, including land use and planning, water resources, biological resources, and socioeconomics.

FEMA does not fund, authorize, or carry out floodplain development pursuant to the NFIP. Nevertheless, some perceive, based on anecdotal evidence, that the NFIP reduces the financial risk to property owners and communities from potential flood disasters through relatively low-cost property insurance. However, as discussed below, the research and empirical evidence on the issue demonstrates that the asserted linkage between the availability of flood insurance and resulting impacts on development or the environment is tenuous. Because the NFIP does not cause development to occur, and does not facilitate or encourage floodplain development, floodplain development is neither a direct nor an indirect effect of the implementation of the NFIP.

Historically, people have been attracted to water as places for living, industry, commerce, and recreation. During the early settlement of the United States, locations near water provided necessary access to transportation and a water supply. Many of the oldest and largest cities in the United States are located near the Atlantic or Pacific Oceans, or on harbors that join the ocean (New York, New Orleans, Boston, Baltimore, San Francisco, etc.). As populations grew and cities began to expand, these locations were very important for trading and shipping, with communities growing in the surrounding areas (job creation). Settlements near water also have fertile soils, making them productive agricultural lands.

This pattern of development continued as communities grew; even after natural disasters destroyed communities, damaged crops, and caused deaths, communities continually chose to rebuild in the floodplain. In April and May 1927, the most destructive historical flood in the United States occurred along the Mississippi River resulting in 500 deaths and leaving 600,000 people without homes. Across Illinois, Missouri, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana, some 16 million acres of land (26,000 square miles) were inundated with water (Webley, 2011). After the floods of 1927, the United States Army Corps of Engineers (USACE) used Federal funds from the Flood Control Act of 1928 to develop a flood-control system for the Mississippi River, allowing for the areas impacted to be rebuilt (Ashley County Ledger, Undated). In 1861-1862, a "megaflood" occurred in Central Valley, CA causing the State to go bankrupt (Ingram, 2012). Today, the same regions that were so greatly damaged in this flooding event, such as the Sacramento area (which also experienced floods in 1849, 1850, 1851, and twice in 1852 and 1853), are some of California's most prosperous and growing cities (Ingram, 2012) (New York Times, 1862). In recent decades, development along waterways and shorelines—areas within floodplains—has been spurred by the aesthetic and recreational value of these locations (AIR - Blais et al., 2006) (Comptroller of the United States, 1982).

As explained in greater detail in Section 3.5 of Appendix C, NFIP Biological Evaluation, numerous factors influence individuals and communities to develop in the floodplain. The key factors identified in the studies reviewed by the Government Accountability Office (GAO) as driving development in the floodplain were the diverse natural resources, abundant wildlife, agricultural lands, commercial and sport fishing resources, and diverse recreational potential. Additional factors identified by GAO include bridge access to barrier islands; community infrastructure such as roads, water, sewers, and utilities; the availability of mortgage and investment capital; construction costs; the state of the economy; and regional and local economic conditions (Comptroller of the United States, 1982).

4.1.1.1 Availability of NFIP Flood Insurance

A history of the NFIP and the available data demonstrate that the availability of flood insurance has proved a very poor incentive to develop in the floodplain. Prior to 1973, there were only 95,000 policies in force under the NFIP. Because of the lack of interest in purchasing flood insurance, Congress passed the Flood Disaster Protection Act of 1973, which required the purchase of flood insurance as a condition of receiving federally backed loans and Federal assistance in Special Flood Hazard Areas (SFHA) of participating communities. Even after the imposition of the mandatory purchase requirement in the 1973 Act, flood insurance purchases were still low. As a result, Congress passed the National Flood Insurance Reform Act of 1994, which required Federal agency lender regulators to develop regulations to direct their federally regulated lenders not to make, increase, extend, or renew any loan on applicable property unless flood insurance is purchased and maintained. The law also addressed the responsibility of regulated lending institutions and Government-Sponsored Enterprises (i.e., Fannie Mae and Freddie Mac) in providing a notice of, and requiring, flood insurance coverage for the term of the loan on buildings located in any SFHA in participating NFIP communities. However, the 1994 Reform Act has also not had a substantial impact in increasing flood insurance purchases.

A 2013 Congressional Research Service report suggested that only 18 percent of Americans in flood zone areas have flood insurance, indicating that other factors, aside from flood insurance, are driving individuals to develop in the floodplain. The Congressional Research Service report also cites to other sources as evidence of such low penetration rates. For example, the study notes that estimates have been provided from insurance experts that only 15 percent to 25 percent of at-risk properties in the SFHA in the Northeast were insured for flood losses (Lee, 2012). Only 38,785 residential and business policies were in force in New York City, out of an estimated 7.2 million households (2010 census), as of August 31, 2012; and only 8,129 households (out of about 39,000 households) and businesses in Atlantic City, NJ, had Federal flood insurance coverage (Lee, 2012).

The Congressional Research Service report found that "despite the existence of this mandatory flood insurance purchase requirement, take-up rates for flood insurance have historically been low and the Federal government's exposure to uninsured property losses from flooding remains substantial. Many homeowners do not completely recognize or internalize their flood risk and are overly optimistic about the magnitude of the flood risk to which they are exposed. Consequently, the NFIP has not achieved the level of individual participation originally envisioned by Congress" (Congressional Research Service, 2013).[6]

The literature on risk perception suggests that public perceptions about low frequency/high damage events, such as flooding, indicate that the availability of flood insurance may do little to encourage floodplain development because property owners frequently have an "optimistic bias"—a tendency to view themselves as invulnerable, or less likely than others, to experience negative life events such as flood damage (Rosenbaum & Boulware, 2006). There is evidence that many homeowners are either not fully aware of the risk of a flood occurring or that they discount the cost of a flood if it occurs. In some cases, owners simply underestimate the risk of flooding. Rosenbaum (2005) notes that many studies find homeowners underestimate the risk of floods and even when informed, few owners react to offset the risk. For example, Chivers and Flores (2002) surveyed homebuyers in Boulder, CO and found a market failure of information in which homeowners did not fully understand the flood risks or cost of insuring against the risk when purchasing their homes. Michel-Kerjan (2010) also noted that, despite the occurrence of floods or natural disasters, homeowners take no action to fortify their homes, likely due to "a lack of accurate knowledge about risk; budget constraints; and myopia." This effect is evident through the actions of homeowners. Michel-Kerjan, Lemoyne de Forges,and Kunreuther (2012) found that homeowners allowed their flood policies to lapse typically after two to four years, even for federally backed mortgages that require flood insurance.[7] This occurs despite the rule prohibiting individuals from applying for flood disaster assistance a second time unless flood insurance has been maintained.

Although more than 22,000 communities participate in the NFIP (FEMA, 2016a), the level of policy uptake within those communities implies that flood insurance availability is not a key driver of individual behavior. A 2006 American Institutes for Research (AIR) report provides a number of data points on the level and concentration of policies within the States, territories, and participating communities that demonstrates this point. Of the participating communities, 67 percent of the participating communities have fewer than 20 policies, and 50 percent have fewer than 10 policies. Further, 70 percent of all policies are concentrated in 5 States, while 3,452 communities have zero policies (AIR - Monday et al., 2006). In 1982, a GAO study concluded that although much development is occurring in the floodplain, flood insurance is not the principal reason for that development. In an interview of 115 people, including 12 Federal officials, 46 State and local government officials, and 57 business people and private citizens, not one person cited flood insurance as the principal factor encouraging their respective decisions to develop in the floodplain (Comptroller of the United States, 1982).

[6] Additionally, a 2006 study of the mandatory purchase requirement conducted by the RAND Corporation indicated that only about 49 percent of single family homes in SFHAs are covered by flood insurance, but the penetration rates vary by geographic location (Dixon, Clancy, Seabury, & Overton, 2006). The *Affordability of National Flood Insurance Program Premiums; Report 1* builds off the findings of the RAND report and agrees that rates vary by geographies, are "particularly low" where purchase is voluntary, and that "many people who are required to purchase the coverage do not" (Dixon, Clancy, Seabury, & Overton, 2006).

[7] For loans made by federally regulated lenders, lenders are responsible for enforcing the flood insurance requirement. However, as explained by Michel-Kerjan, Lemoyne de Forges, and Kunreuther (2012), some banks do not ensure the policies remain in force.

Looking more broadly to the link between the implementation of the NFIP generally and floodplain development, the studies have not shown that there is any demonstrable connection. For example, the GAO analyzed floodplain development data both before and after a community entered the NFIP. The GAO used (1) available U.S. Census Bureau data on population, per capita income, and new housing units authorized by building permits and public contracts in the United States, and (2) building permits which the selected communities reportedly issued. The GAO's analysis concentrated on population growth and increases in housing units authorized for construction. The GAO compared the rate of population growth in a 20-year period with the dates the communities entered the program. Generally, the communities were growing before their entrance into the program from 1960 to 1970, and this rate of growth continued from 1970 to 1980.

The GAO obtained data on new housing units authorized for a 10-year period for the nation and the three larger communities, but the GAO was only able to obtain this data from 1977 to 1980 for the three smaller communities. New housing units authorized were increasing in all three larger communities prior to their entrance into the flood insurance program and continued to increase thereafter. The GAO was unable to attribute the rate of increase in new housing units authorized to the availability of flood insurance because of the many other factors that promote community development. The GAO found that annual increases and decreases in new housing units authorized generally paralleled the rise and decline of total housing units authorized in the nation and seemed to be more directly related to the state of the economy than the availability of flood insurance.

The AIR took a different approach and looked at floodplain development in areas where flood insurance is available compared to areas in which it is not available (e.g., Coastal Barrier Resources System [CBRS] units). In this study, AIR found that many CBRS units have been developed, often quite extensively, despite the absence of NFIP flood insurance. The report noted that development appeared to result from a combination of State and local government incentives and market forces. For example, units in Bethany Beach, DE; North Topsail Beach, NC; and Cape San Blas, FL studied in 1997 developed very much like nearby non-System areas. The report further found that market forces appear to be an increasingly potent source of developmental pressure on CBRS units as undeveloped coastal barrier land becomes increasingly scarce (AIR - Rosenbaum, W., 2005).[8]

[8] Notably, as part of the same series of reports produced by AIR, there was also a study that concluded that while floodplain development would continue even in the absence of flood insurance, it was a factor in a property owner’s decision to build in the floodplain. However, FEMA did not believe the conclusions reached in this study were sufficiently credible to merit use in this analysis. The AIR study was actually a survey of floodplain administrators, real estate brokers, mortgage lenders, community developers, and insurance agents concerning the interests important to community development. The study sample size was 188 individuals, which, as acknowledged by the authors, is not a statistically valid sample size from which credible scientific and factual conclusions may be drawn (see Appendix 3 of the 2006 AIR report). Additionally, the questions for the vast majority of those surveyed (163 of 188) focused on the perceptions of the survey respondents about *others' behavior and motivations* (e.g., "Could you tell me what factors [from the options listed in the survey] you think might influence a person’s decision to purchase or build property in the floodplain?").

As reported in the FEMA *Floodplain Management Losses Avoided Study*, more than half (57 percent) of residential properties located in SFHAs were built prior to the inception of the NFIP. As such, it is clear that development has occurred, and would continue to occur, in the SFHA even in the absence of flood insurance. Thus, the research and empirical evidence demonstrate that the availability of flood insurance has very little effect on the motivation to develop the floodplain, which was already well established prior to the inception of the program (FEMA, 2014).

4.1.1.2 NFIP's Role in Restraining Floodplain Development

The NFIP regulates and discourages development in the SFHA through its floodplain management and flood hazard mapping activities. NFIP participating communities must incorporate the NFIP's minimum floodplain management criteria into local laws and ordinances and ensure that development within the SFHA is compliant with those local laws and ordinances. However, NFIP participating communities can adopt more stringent standards and are encouraged to do so. Under the Community Rating System (CRS), communities can get discounts on their flood insurance premiums for the adoption of higher regulatory standards. Additionally, flood hazard mapping promotes awareness of flood hazards, which can help to discourage floodplain development in areas where there is a significant risk of flooding. Each of these is discussed in detail in the subsections below.

4.1.1.2.1 Floodplain Management Criteria

Under the NFIP regulations, participating NFIP communities are required to regulate all development in FEMA-mapped SFHAs. Before a property owner can undertake any development in the SFHA, a permit must be obtained from the community. The community is responsible for reviewing the proposed development to ensure that it complies with the community's floodplain management ordinances and that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law. For many communities, if a "regulatory floodway" is required, the floodway must be designated to follow established guidelines under the NFIP. Once a floodway is designated, the community must only allow development in the floodway that would not cause an increase in flood heights. A 2006 AIR report found that in many communities, the NFIP has often restrained development in high-hazard floodplains and promoted safer construction in flood-prone areas through its floodplain management requirements (AIR - Monday et al., 2006).

4.1.1.2.2 Community Rating System

A component of the NFIP that encourages conservation of floodplain resources is the CRS. The CRS, which is discussed in Section 1.3.1.8, is a voluntary program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards through the provision of flood

---

As explained in the preceding paragraphs of this section, there have been countless studies showing that people's perceptions, especially about events and people external to themselves, are often very inaccurate. Based on the perceptions of this limited sample size of survey respondents, the AIR study concluded that while a majority of community floodplain administrators, real estate brokers, mortgage lenders, community developers, and insurance agents believed that flood insurance was an important factor in property owner's decisions about floodplain management ownership, they also believe that most people would continue to purchase, build, and stay in the floodplain in the absence of flood insurance. While this study may offer some insight on the perceptions of NFIP stakeholders about factors affecting community development, perceptions are not facts, and they cannot form the basis for a factual, data-driven determination about the impacts of the NFIP.

insurance premium discounts. Under the CRS, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the CRS activities that communities implement. Depending on the number of credits they receive from CRS activities, communities qualify for different rating classes, which correspond to different discounts they can receive. Depending on rating class, discounts on flood insurance premium rates can be between 5 and 45 percent. This provides a financial incentive for communities to implement better floodplain management and mitigation activities that exceed the minimum NFIP standards.

By exceeding the minimum NFIP standards, CRS activities can provide additional protections to the floodplain, and the environmental resources therein, by preserving its natural and beneficial functions and reducing potential flood losses of floodplain development. These activities include measures like preserving open space and natural areas, creating higher standards for stormwater management, regulating development in the floodplain, and increasing public awareness of flood risks by providing flood risk maps and other data. In the 2006 AIR report, it was noted that the implementation of the floodplain management criteria has the effect of restraining some development (AIR - Monday et al., 2006). This effect should be even greater with respect to the implementation of CRS, since the standards in CRS communities would exceed the minimum floodplain management criteria standards. By increasing the level of regulation applicable to development taking place in the floodplain through the CRS program, the CRS-participating communities are taking measures that may act to restrain development in high hazard floodplains.

4.1.1.2.3 Flood Hazard Mapping

By promoting broad based awareness of the risks associated with living in a floodplain, FEMA's flood hazard maps provide information that can encourage development away from flood hazard areas. FEMA also provides best available data, and upon request by the community, future conditions maps. This information may then be used by the communities and individuals to guide future decision-making regarding floodplain development and can discourage continued development in flood hazard areas.

4.1.2 Methods of Impact Analysis

The methodology for the impact analysis based on the guidance found in CEQ’s *NEPA Implementing Regulations*: 40 C.F.R. § 1502.24 (Methodology and Scientific Accuracy); 40 C.F.R. § 1508.7 (Cumulative Impact); 40 C.F.R. § 1508.8 (Effects); and CEQ’s guidance on *Effective Use of Programmatic NEPA Reviews* (CEQ, 2014). The CEQ regulations require that agencies evaluate the impact of all alternatives. This NPEIS document addresses the broad environmental consequences at the programmatic level. Since this NPEIS addresses environmental effects over a large geographic area and period of time, the extent, depth, and detail of the impact analysis reflects the "broad and general impacts that might result from making broad programmatic decisions." This NPEIS analyzes impacts of a continuous sequence of activities at a programmatic level. As such, effects of the program as a whole would be long-term. In addition, the analysis is more qualitative in nature than those in project or site-specific NEPA reviews. (CEQ, 2014)

4.2 RESOURCE AREAS WITH NO IMPACTS

There are a number of resource areas that FEMA has identified as having no impacts as a result of implementation of the alternatives. As discussed above, floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. Moreover, FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under each State's police powers, which the Constitution reserves to the States; the States delegate this power down to their respective political subdivisions. Therefore, floodplain development is regulated at the community level through the community's floodplain management regulations and permitting process for development in the floodplain. As such, FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain.

Continued implementation of the NFIP, including implementation of the NFIP as modified by the alternatives, would not include any physical development or ground disturbance in the floodplain, nor would it encourage any development in the floodplain to occur. As discussed below, because the implementation of the alternatives does not involve authorizing, funding, undertaking, or encouraging development in the floodplain, there would be no impacts to the following resource areas as a result of implementation of the alternatives: Air Quality, Noise, Geology and Soils, Aesthetic/Visual Resources, Hazardous Wastes and Materials, Climate Change, Historic and Cultural Resources, and Infrastructure.

4.2.1 Air Quality

4.2.1.1 Significance Criteria

An evaluation of air quality impacts involves a comparison of proposed activities to the existing air quality. An alternative would result in adverse air quality impacts if:

- The magnitude or intensity of air emissions would increase,
- The geographic extent/content of air emissions would increase, or
- The duration and frequency of air emissions increases.

This NPEIS analysis reviews the potential air quality impacts for the alternatives. Table 4-1 provides a summary of the potential air quality impacts.

Table 4-1: Potential Air Quality Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Magnitude or intensity of increased air emissions	No impact	No impact	No impact	No impact
Geographic extent/context of increased air emissions	No impact	No impact	No impact	No impact

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Duration or frequency of increased air emissions	No impact	No impact	No impact	No impact

4.2.1.2 Alternative 1 (No Action Alternative)

The NFIP makes Federal flood insurance available to property owners or lessees for participating communities. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities, not FEMA, are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under each State's police powers, which the Constitution reserves to the States; the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level by the community, not FEMA, through the community's floodplain management regulations and permitting process for development in the floodplain. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, reviewing the proposed development to ensure compliance with their floodplain management ordinances, and verifying that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Development in the floodplain is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such development in the floodplain to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP.

Under the No Action Alternative, FEMA would continue the policies and program elements of the existing NFIP. Continued implementation of the NFIP would not include any physical development or ground disturbance in the floodplain, nor would it encourage any development in the floodplain to occur. There would be no construction activities from implementing the No Action Alternative. As a result, there would be no increase in the magnitude or intensity of emissions from vehicles or heavy equipment, fugitive dust, or particulates generated from disturbed soils, nor would the geographic extent of emissions increase. Due to the absence of air emissions, the duration or frequency of air emissions would not increase. In summary, there would be no impact to existing air quality at or adjacent to NFIP communities through implementation of Alternative 1.

4.2.1.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders are policyholders whose residences were built prior to the community's first FIRM. Since nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that recently joined the NFIP. The likelihood of a project proponent making a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote.[9]

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, such that these policies are actually more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, the monthly installment payment plan option is simply an administrative change to expand the payment options available to certain NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could increase emissions.

Implementing these legislatively required insurance changes would not cause or result in any development or construction activities. As a result, there would be no increase in emissions, or the magnitude or intensity of emissions, from construction vehicles or heavy equipment, fugitive dust, or particulates generated from disturbed soils, nor would the geographic extent of emissions increase. Due to the absence of air emissions, the duration or frequency of air emissions would not increase. In summary, there would be no impact to existing air quality through implementation of these legislatively required insurance changes.

[9] Notably, even under the remote possibility that a project proponent were to consider potentially applicable subsidy phase outs (i.e., in the event their community was mapped and joined the NFIP) in determining whether or not to develop in the floodplain, the applicability of higher premium rates would discourage such development.

Under Alternative 2, current NFIP regulations would be clarified to expressly state that FEMA would require communities to obtain and maintain documentation of compliance with appropriate Federal or State laws, including the ESA, prior to the issuance of permits for development in the floodplain per 44 C.F.R. § 60.3(a)(2). No construction activities would occur with the implementation of this proposed clarification. As a result, there would not be an increase in the magnitude or intensity of emissions from construction vehicles or heavy equipment, fugitive dust, or particulates generated from disturbed soils nor would the geographic extent/context of air emissions increase. Due to the absence of emissions, the duration or frequency of air emissions would not increase. No new sources of air emissions would be created under the change. In summary, there would be no impact to the existing air quality with the implementation of the proposed clarifications to FEMA's floodplain management compliance documentation requirements would not affect existing air quality.

The change clarifying that issuance of certain LOMC requests would be contingent upon the provision of documentation of compliance with the ESA would not increase air emissions at or adjacent to NFIP communities nor would the action create new sources of air emissions. There would be no construction activities as a result of implementing this proposed clarification. As a result, there would be no increase in the magnitude or intensity of emissions from construction vehicles or heavy equipment, fugitive dust, or particulates generated from disturbed soils, nor would the geographic extent, duration, or frequency of air emissions increase. Therefore, there would be no impact to existing air quality at or adjacent to NFIP communities through implementation of Alternative 2.

4.2.1.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the development of a monthly installment plan payment option would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.2.1.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under the new ESA-related performance standard, communities would be required to obtain and maintain documentation to show ESA compliance and that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, would be mitigated to the maximum extent possible. An increase in construction activities is not expected as a result of implementation of the new ESA-related performance standard. As a result, there would be no increase in the magnitude or intensity of emissions from construction vehicles or heavy equipment, fugitive dust, or particulates generated from disturbed soils, nor would the geographic extent/content increase. This change would not cause any increases in the duration or frequency of air emissions at or adjacent to NFIP communities. No new sources of air emissions would be created under the new ESA-related performance standard. Additionally, implementation of the new performance standard would not affect air quality. Therefore, implementation of the new ESA-related performance standard would not impact existing air quality.

Under the ESA Regulatory Changes, current NFIP regulations would also be clarified to expressly state that the current exception to the no-rise performance standard would only apply to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. According to FEMA's estimates, the number of non-public purpose projects that were built in the floodway due to the lack of clarification that would be provided under this alternative would be 15 projects per year. As such, there may be slightly less floodway development as a result of this change (unless the proposed floodway development were redesigned so as not to cause a rise in the floodway). Accordingly, no increase in the magnitude or intensity of air emissions would be created, nor would the geographic extent/context increase. The change would not cause an increase in the duration or frequency of current air emissions. Therefore, implementation of the new ESA-related performance standard would not impact air quality.

In addition, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to policyholders in NFIP communities placed on probation would be increased from $50 to $100. No construction activities from implementing this new probation surcharge would occur. As a result, this change would not increase the magnitude, intensity, geographic extent/context, or duration/frequency of air emissions. Therefore, there would be no impact to the existing air quality at or adjacent to NFIP communities through implementation of this new probation surcharge.

4.2.1.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the implementation of a monthly installment plan payment option would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.2.1.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

For the ESA Guidance, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private floodplain development was undertaken in compliance with the ESA. Documentation requirements related to the ESA Guidance would not generate air emissions and would not affect existing air quality. FEMA would not carry out any construction activities to implement this alternative. As a result, this change would not increase the magnitude, intensity, geographic extent/content, or duration/frequency of air emissions. There would be no impact to the existing air quality at or adjacent to NFIP communities through implementation of the new ESA-related Guidance. Therefore, there would be no impact to the existing air quality at or adjacent to NFIP communities through implementation of Alternative 4.

4.2.2 Noise

4.2.2.1 Significance Criteria

An evaluation of noise impacts involves a comparison of proposed activities to current noise levels. An alternative would result in adverse noise impacts if:

- Noise levels would exceed typical noise levels from construction equipment and generators; or
- Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 A-weighted decibel (dBA) or specific State noise limits.

This NPEIS analysis reviews the potential noise impacts for the alternatives. Table 4-2 provides a summary of the potential noise impacts.

Table 4-2: Potential Noise Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Noise levels exceed typical noise levels from construction equipment and generators	No impact	No impact	No impact	No impact
Noise levels at noise sensitive receptors exceed 55 dBA or specific State noise limits	No impact	No impact	No impact	No impact

4.2.2.2 Alternative 1 (No Action Alternative)

The NFIP makes Federal flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under the State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level through the community's floodplain management regulations and permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, and for reviewing the proposed development to ensure compliance with their floodplain management ordinances and that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP.

Under the No Action Alternative, FEMA would continue to manage the NFIP in its current state. Continued implementation of the NFIP would not include any physical development or ground disturbance in the floodplain, nor would it encourage any development in the floodplain to occur. There would be no construction or development activities from implementing this alternative. As a result, there would be no new noise sources, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits. The NFIP would continue to operate using its current policies, rules, and regulations, resulting in no noise impacts.

4.2.2.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders are policyholders whose residences were built prior to the community's first FIRM. Since nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that recently joined the NFIP. The likelihood is remote that a project proponent will make a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote.

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, such that these policies are actually more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, because this change is simply an administrative change to the insurance payment options of NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could impact noise, this change would have no impact on noise. Implementing these legislatively required insurance changes would not cause or result in any development or construction activities. As a result, their implementation action would not create new sources of noise or affect existing noise levels noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits. Therefore, there would be no impact to the existing noise levels through implementation of these legislatively required insurance changes.

Clarifying that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain is an administrative task that would not involve physical disturbance or construction/development activities. As such, this clarification would not create new sources of noise or impact existing noise levels, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits.

Likewise, no new sources of noise would be created from the proposed clarifications to FEMA's LOMC request (i.e., map revision) procedures. The proposed clarification to require documentation demonstrating compliance with the ESA as a condition of issuing LOMC requests would not result in physical activities that would affect current noise conditions or create new sources of noise. In sum, the proposed clarification would not increase ambient noise levels or create new sources of noise, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits. Therefore, no noise impacts would occur through implementation of Alternative 2.

4.2.2.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts associated with phasing out subsidies, implementing a monthly installment plan, and clarifying the issuing of LOMC requests would be the same as those described in Alternative 2 (Section 4.2.2.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, would be mitigated to the maximum extent possible. Implementing the new ESA-related performance standard would not result in any activities, such as construction or development activities, that would cause increases to ambient noise levels at or adjacent to NFIP communities. No new sources of noise would be created under the new performance standard. Implementation of the ESA-related performance standard would not increase existing noise levels, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed established limits.

Under the ESA Regulatory Changes, current NFIP regulations would also be clarified to expressly state that the current exception to the no-rise performance standard would only apply to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. According to FEMA's estimates, the number of non-public purpose projects that were built in the floodway due to the lack of clarification that would be provided under this modification is 15 projects per year. As such, there may be slightly less floodway development as a result of this change (unless the proposed design of the floodway development were revised to no cause a rise in the floodway). No new noise impacts would be created, no increases in current ambient noise levels would be experienced, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits.

Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to policyholders in NFIP communities that have been placed on probation would be increased from $50 to $100. The increase in the probation surcharge would not result in any activities that could create new noise impacts, would not result in increases in current ambient noise levels, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits. Therefore, no noise impacts would occur through implementation of Alternative 3.

4.2.2.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts associated with phasing out subsidies, implementing a monthly installment plan, and clarifying the issuance of LOMC requests would be the same as those described in Alternative 2 (Section 4.2.2.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

Under Alternative 4, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private development in the floodplain was undertaken in compliance with all applicable Federal and State laws, including the ESA. This proposed clarification would not result in any physical activities that could cause any increases to ambient noise levels. No new sources of noise would be created in implementing the ESA Guidance requirements, noise levels would not exceed typical construction levels, and noise levels at sensitive receptors would not exceed limits. Therefore, no noise impacts would occur through implementation of Alternative 4.

4.2.3 Geology and Soils

4.2.3.1 Significance Criteria

An evaluation of geology and soils impacts involves a comparison of current and future proposed conditions and a projection of the extent to which the Preferred Alternative and alternatives might alter the current geologic setting. There is the potential for geology and soils impacts to occur when an activity:

- Significantly increases erosion or decreases the landscape stability, or
- Significantly increases the potential for impacts from land subsidence.

This NPEIS analysis reviews the potential impacts to geology and soils resources by alternatives. Table 4-3 presents a summary of the potential impacts for geology and soils.

Table 4-3: Potential Geology and Soils Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Soil erosion	No impact	No impact	No impact	No impact
Land subsidence susceptibility	No impact	No impact	No impact	No impact

4.2.3.2 Alternative 1 (No Action Alternative)

The NFIP makes Federal flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under the State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level through the community's floodplain management regulations and permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, and for reviewing the proposed development to ensure compliance with their floodplain management ordinances and that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP.

Under the No Action Alternative, FEMA would continue the policies and program elements of the existing NFIP. Continued implementation of the NFIP would not include any physical development or ground disturbance in the floodplain, nor would FEMA encourage any development in the floodplain to occur. There would be no ground disturbance, and therefore no increase in erosion, decrease in landscape stability, or increase in the potential for land subsidence from the implementation of the No Action Alternative. Therefore, no NFIP activities would impact geology and soils.

4.2.3.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders are policyholders whose residences were built prior to the community's first FIRM. Since nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that recently join the NFIP. The likelihood of a project proponent making a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote and speculative and thus is not considered in a discussion of the impacts of this alternative.

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, these policies are actually more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, because this change is simply an administrative change to the insurance payment options of NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could impact geology and soils, this change would have no impact on geology and soils.

Implementing these legislatively required insurance changes would not cause or result in any development or construction activities. As a result, there would be no ground disturbance, and therefore no increase in erosion, decrease in landscape stability, or increase in potential for land subsidence. There would be no impact to geologolical or soil conditions through implementation of these legislatively required changes.

Changes to clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain would be an administrative task that would not involve any physical development or construction activities. Without physical development or construction activities that could disrupt current soil or geological conditions, there would be no increase in erosion, decrease in landscape stability, or increase in the potential for land subsidence. Therefore, this change would not impact geology and soils.

Clarifications to FEMA's LOMC procedure to require documentation of compliance with the ESA as a condition of issuing certain LOMCs would not involve any physical development or construction activities, especially because FEMA only issues LOMCs after floodplain development has already taken place. As such, these clarifications would not affect current soil or geological conditions, nor result in an increase in erosion, decrease in landscape stability, or increase in the potential for land subsidence. Therefore, implementation of the change to FEMA's LOMC procedures would not impact geology and soils. In sum, implementing Alternative 2 would not impact geology and soils.

4.2.3.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for phasing out subsidies, implementating a monthly installment plan payment option, and clarifying certain LOMC requests included in Alternative 3 would be the same as those described in Alternative 2 (Section 4.2.3.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, would be mitigated to the maximum extent possible. No construction activities, ground disturbance, or other physical developments causing soil removal or other changes to existing geology and soil conditions would occur as a result of implementing this new performance standard. Therefore, there would be no increase in erosion, decrease in landscape stability, or increase in the potential for land subsidence. As a result, no impacts to geology and soils would result from this change.

In addition, under the ESA Regulatory Changes, FEMA would clarify that the current exception to the no-rise performance standard in the floodway would only apply to projects that serve a public purpose or result in the restoration of the natural and beneficial functions of floodplains. Continuation of the existing standards would not involve physical development or ground disturbance in the floodplain, nor result in increased potential for land subsidence or soil erosion susceptibility. Additionally, FEMA determined that the clarifications made pursuant to this alternative would result in approximately 15 fewer development projects being located in floodways per year than are currently located there now. Because this clarification would only affect 15 projects per year across the nation, any significant impacts – beneficial or adverse − to geology and soils would not be expected.

Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to policyholders in NFIP communities placed on probation would be increased from $50 to $100. No construction activities or other physical development would occur from implementing this new probation surcharge. As a result, there would be no ground disturbance that could result in an increase in erosion, decrease in landscape stability, or increase in the potential for land subsidence. Therefore, implementing the new probation surcharge would not impact geology and soils. In sum, implementation of Alternative 3 would not affect existing geology and soils.

4.2.3.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for phasing out subsidies, implementing a monthly installment plan payment option, and clarifying certain LOMC requests included in this alternative would be the same as those described in Alternative 2 (Section 4.2.3.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

Under this Alternative, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private floodplain development was undertaken in compliance with the ESA. These ESA compliance documentation requirements would not involve any physical development or construction activities. As a result, there would be no ground disturbance that could lead to an increase in erosion, decrease in landscape stability, or increase in the potential for land subsidence. Therefore, there would be no impact to existing geology and soils through implementation of the ESA Guidance. In sum, the implementation of Alternative 4 would not affect existing geology and soils.

4.2.4 Aesthetics/Visual Resources

4.2.4.1 Significance Criteria

An evaluation of aesthetic/visual resource impacts involves a comparison of landscape characteristics and a determination of the extent to which the alternatives might change visual aspects of landscape and associated scenery. There is the potential for significant aesthetic/visual resource impacts to occur when an activity:

- Substantially affects the scenic vista by changing the form, line, texture, or color of the landscape;
- Substantially damages scenic resources;
- Substantially degrades the existing visual character of a site and/or its surroundings; or
- Increases the likelihood of manmade structures being constructed on previously natural landscapes.

Table 4-4 provides a summary of the potential aesthetic/visual resource impacts.

Table 4-4: Potential Aesthetics/Visual Resource Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Substantially affects the scenic vista by changing the form, line, texture, or color of the landscape	No impact	No impact	No impact	No impact
Substantially damages scenic resources	No impact	No impact	No impact	No impact
Substantially degrades the existing visual character of a site and/or its surroundings	No impact	No impact	No impact	No impact
Increases the likelihood of manmade structures being constructed on previously natural landscapes	No impact	No impact	No impact	No impact

Due to the vast size and variability of the United States, this NPEIS cannot describe each visual resources in the nation; rather, Chapter 3 in this NPEIS describes representative features of aesthetic resources along the nation's waterways and coastlines within flood-prone areas. This section provides a broad view of potential consequences as they apply to notable scenic resources (Section 3.9.4) and aesthetic and scenic resources in general.

4.2.4.2 Alternative 1 (No Action Alternative)

The NFIP makes Federal flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under the State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. Therefore, floodplain development is regulated at the community level through the community's floodplain management regulations and permitting process for development in the floodplain. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, and for reviewing the proposed development to ensure compliance with their floodplain management ordinances and that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP.

Under the No Action Alternative, FEMA would continue the existing management included in the NFIP. FEMA does not, pursuant to the NFIP, cause, fund, permit, undertake, or encourage floodplain development. There would be no ground disturbance or development construction activities that could affect scenic vistas, damage scenic resources, degrade existing visual character, or increase the likelihood of manmade structures being constructed on previously natural landscapes. Therefore, implementation of the No Action Alternative would result in no impacts to aesthetic or visual resources.

4.2.4.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders are policyholders whose residences were built prior to the community's first FIRM. Since nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that recently joined the NFIP. The likelihood of a project proponent making a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote.

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, such that these policies are actually more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, because this change is simple an administrative change to the insurance payment options of NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could impact aesthetic or visual resources, this change would have no impact on aesthetic and visual resources.

No construction or development activities would occur as a result of implementing these legislatively required insurance changes. No land clearing or removal of vegetation would occur. Because no activities related to implementation of this alternative would take place in any landscape or outdoor area, the implementation of these legislatively required changes would not affect scenic vistas, damage scenic resources, degrade existing visual character, or increase the likelihood of manmade structures being constructed on previously natural landscapes. Therefore, the legislatively required changes would not affect existing aesthetic and visual resources.

Under Alternative 2, changes would be made to clarify that, pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of the issuance of a permit to develop in the floodplain. Also under Alternative 2, changes would be made to clarify that FEMA will now require documentation of ESA compliance as a condition of all map change requests. Alternative 2 does not impose any additional requirements or change any substantive aspects of the program related to aesthetic and visual resources. These clarifications would not involve any development or construction actions. Indeed, in the case of map change requests, the development has already taken place. No land clearing or removal of vegetation would occur. Because no activities would take place in any landscape or outdoor area, the implementation of these changes would not affect scenic vistas, damage scenic resources, degrade existing visual character, or increase the likelihood of manmade structures being constructed on previously natural landscapes. In sum, no impacts would occur to aesthetic and visual resources through implementation of Alternative 2.

4.2.4.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for the legislatively required LOMC clarifications of this alternative would be the same as those described in Alternative 2 (Section 4.2.4.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, would be mitigated to the maximum extent possible.

Under the ESA Regulatory Changes, the current NFIP floodplain management regulations would also be clarified to expressly state that the current exception to the no-rise performance standard would only apply to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to NFIP communities that have been placed on probation would be increased from $50 to $100.

FEMA does not authorize, fund, or carry out floodplain development pursuant to the NFIP, nor does it encourage such development to occur. Moreover, FEMA's current role in floodplain management is to set performance standards. FEMA has no direct influence on land use or where development takes place. The implementation of these changes would not change FEMA's role; NFIP floodplain development; or involve any physical development in the floodplain that could affect scenic vistas, damage scenic resources, degrade existing visual character, or increase the likelihood of manmade structures being constructed on previously natural landscapes. Accordingly, implementation of the ESA Regulatory Changes would not affect aesthetic or visual resources. Therefore, the implementation of Alternative 3 would have no effect on aesthetic or visual resources.

4.2.4.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for the legislatively required and LOMC clarifications of this alternative would be the same as those described in Alternative 2 (Section 4.2.4.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

Under Alternative 4, FEMA would use the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private development in the floodplain was undertaken in compliance with the ESA. Alternative 4 does not impose any additional requirements or change any substantive aspects of the program related to aesthetic and visual resources. Furthermore, FEMA does not authorize, fund, or carry out floodplain development pursuant to the NFIP, nor does it encourage such development to occur. FEMA's current role in floodplain management is to set performance standards, the agency has no direct influence on land use or where development takes place. The implementation of this change would not change FEMA's role; NFIP floodplain development; or involve any physical development in the floodplain that would affect scenic vistas, damage scenic resources, degrade existing visual character, or increase the likelihood of manmade structures being constructed on previously natural landscapes. Accordingly, implementation of the ESA Guidance would not affect aesthetic or visual resources. Therefore, the implementation of Alternative 4 would have no effect on aesthetic or visual resources.

4.2.5 Hazardous Wastes and Materials

4.2.5.1 Significance Criteria

An evaluation of hazardous wastes and materials impacts involves a comparison of hazardous wastes and materials sites and facilities in the United States, and a determination of the extent to which the alternatives might be incompatible with these operations. There is the potential for impacts due to hazardous waste and material when an activity:

- Constitutes a fundamental change in the quantity or type of hazardous wastes or materials;
- Creates a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials; or
- Creates a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials into the environment.

This NPEIS analysis reviews the potential hazardous wastes or materials impacts for the alternatives. Table 4-5 provides a summary of the potential hazardous wastes and materials impacts.

Table 4-5: Potential Hazardous Wastes and Materials Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Constitutes a fundamental change in the quantity or type of hazardous wastes or materials	No impact	No impact	No impact	No impact
Creates a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials	No impact	No impact	No impact	No impact
Creates a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials into the environment	No impact	No impact	No impact	No impact

4.2.5.2 Alternative 1 (No Action Alternative)

Under the No Action Alternative, the NFIP includes Floodplain Management, Flood Insurance, and Flood Hazard Mapping. The primary goal of the NFIP is to make flood insurance available in all NFIP participating communities and encourage risk reduction activities through implementation of community floodplain management criteria. By communities electing to participate in the NFIP, property owners can purchase NFIP flood insurance and receive assistance for flood-related damages. Through its Flood Hazard Mapping Program, Risk Mapping, Assessment, and Planning (Risk MAP), FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to protect property against potential future flood losses.

As a condition of participating in the NFIP, communities incorporate the required minimum floodplain management criteria into local ordinances and regulations. Floodplain management is carried out at the State and local levels, where land use authority resides. The community regulates development in the floodplain through locally issued permits; the community has the authority to issue or deny permits for development in the floodplain. Likewise, each community monitors compliance and enforcement of individual permits. FEMA's only action is to determine whether the adopted ordinances meet FEMA's minimum standards. The community must then uniformly enforce its ordinances (44 C.F.R. § 60.1(b)). Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does the NFIP encourage such development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may occur in the floodplain.

There is no requirement in the NFIP specifically limiting the location of critical facilities, such as nuclear power plants. However, through the CRS, FEMA encourages communities and localities to establish ordinances prohibiting the construction of critical facilities within the 500-year floodplain and the storage of hazardous materials within the SFHA or even the 500-year floodplain.

Hazardous materials facilities located within flood hazard areas already must comply with the minimum floodplain management criteria, as well as appropriate Federal, State, and local regulations, including laws and regulations concerning the use and disposal of hazardous materials and hazardous wastes. Since FEMA does not authorize, fund, or carry out floodplain development pursuant to the NFIP, nor does it encourage such floodplain development to occur, implementation of the No Action Alternative would not generate any new hazardous materials or wastes; constitute a fundamental change in the quantity or type of hazardous wastes or materials; or create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials or create a hazard through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials. Based on the policies and program elements of the existing NFIP, implementation of the No Action Alternative would result in no impacts to hazardous wastes and materials resources.

4.2.5.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. The changes under Alternative 2 to phase out subsidies on pre-FIRM properties could lead to higher flood insurance costs to affected properties or facilities, such as Toxics Release Inventory (TRI) facilities, that are insured under the NFIP. However, for any affected hazardous material facilities, the resulting financial impact to property owners and the value of properties would likely be minimal because the rise in premiums are small in relation to overall operational costs. Additionally, any increase in operational costs passed along to consumers would be negligible.

Implementing a monthly installment plan payment option for non-escrowed flood insurance policies would not generate new hazardous materials or wastes, nor would it involve the creation of a significant hazard to the public or the environment. Because FEMA intends to add a monthly service fee to installment plan policies, these policies are actually more expensive than annual policies, and would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, because this change is simply an administrative change to the insurance payment options of NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could impact hazardous wastes and materials.

Implementing these legislatively required insurance changes would not cause or result in any development or construction activities. As a result, this change would have no impact to the quantity or type of hazardous wastes or materials, nor would their implementation create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials.

Accordingly, there would be no direct impacts to hazardous wastes or materials from implementation of these legislatively required insurance changes.

Under this alternative, FEMA would clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain. In addition, FEMA's map change request procedure would be clarified to require documentation of ESA compliance before certain LOMC requests could be issued. As with the No Action Alternative, hazardous materials facilities located within flood hazard areas already must comply with the minimum floodplain management criteria and appropriate Federal, State, and local regulations, including laws and regulations concerning the use and disposal of hazardous materials and hazardous wastes. It is also notable that the private floodplain development for which a map change request is sought has already taken place. Therefore, any legal compliance activities related to such development would have taken place before FEMA's involvement. Because such development is already subject to per the requirements of 44 C.F.R. § 60.3(a)(2), including the requirement that floodplain development must comply with all applicable Federal and State laws before a permit to develop in the floodplain may be issued, and because the floodplain development for which a map change request is made has already taken place, implementation of Alternative 2 would not conflict with existing laws or policies concerning the regulations of hazardous materials and wastes. Additionally, because FEMA does not authorize, fund, or carry out floodplain development pursuant to the NFIP, nor does it encourage such floodplain development to occur, implementation of Alternative 2 would not generate any new hazardous materials or wastes; constitute a fundamental change in the quantity or type of hazardous wastes or materials; create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials; or create a hazard through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials. As such, there would be no direct impacts to existing hazardous wastes and materials resources from changes to LOMC documentation requirements. In sum, implementation of Alternative 2 would not impact hazardous wastes and materials.

4.2.5.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts associated with phasing out subsidies, implementing a monthly installment plan, and clarifying the issuing of LOMC requests would be the same as those described in Alternative 2 (Section 4.2.5.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, will be mitigated to the maximum extent possible. Additionally, under the ESA Regulatory Changes, current NFIP regulations would be clarified to expressly state that an exception to the current no-rise performance standard would only be made for projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains.

Hazardous materials facilities located within flood hazard areas, such as nuclear power plants; TRI facilities; and treatment, storage, and disposal facilities must already comply with the minimum floodplain management criteria and appropriate Federal, State, and local regulations. These include the ESA and laws and regulations concerning the use and disposal of hazardous materials and hazardous wastes, to receive a permit to develop in the floodplain. As such, implementation of these changes would not conflict with existing laws or policies concerning the regulation of hazardous materials and wastes.

Moreover, communities would have the option of satisfying the mitigation requirements of the new ESA-related performance standard through a Section 10 incidental take permit, or a Section 7 incidental take statement obtained through another Federal agency. As a result, the permitting process for hazardous material facilities should not be significantly affected by the new ESA-related performance standard since there would be no new requirements imposed under this rule for ESA-compliant projects, other than the requirement to obtain and maintain documentation of such compliance. However, because the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), collectively referred to as the Services, have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to ascertain whether the change would increase the levels of ESA compliance in NFIP participating communities. FEMA can state that to the extent that a particular project would not otherwise comply with the ESA, such projects may experience delays in the approval process while ESA compliance documentation is being obtained.

Furthermore, FEMA does not authorize, fund, or carry out floodplain development pursuant to the NFIP, nor does it encourage such floodplain development to occur. Therefore, implementation of these changes would not generate any new hazardous materials or wastes; constitute a fundamental change in the quantity or type of hazardous wastes or materials; create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials; or create a hazard through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials. There would be no direct impacts to existing hazardous wastes and materials resources from the new ESA-related performance standard.

Also under the ESA Regulatory Changes, the probation surcharge applicable to NFIP communities that have been placed on probation would be increased from $50 to $100. Implementation of this surcharge increase could lead to higher flood insurance costs to affected properties or facilities, such as TRI facilities, that are insured under the NFIP. However, for any affected hazardous material facilities, the resulting financial impact to property owners and the value of properties would likely be minimal because the rise in insurance policy costs are small in relation to overall operational costs. Any increase in operational costs passed along to consumers would be negligible. Additionally, the probation surcharge would not generate any new hazardous materials or wastes; constitute a fundamental change in the quantity or type of hazardous wastes or materials; create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials; or create a hazard through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials. In sum, implementation of Alternative 3 would not impact hazardous wastes and materials.

4.2.5.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts associated with phasing out subsidies, implementing a monthly installment plan, and clarifying the issuing of LOMC requests would be the same as those described in Alternative 2 (Section 4.2.5.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

For the ESA Guidance, FEMA would use the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private floodplain development was undertaken in compliance with the ESA. Hazardous materials facilities located within flood hazard areas, such as TRI facilities; treatment, storage, and disposal facilities; and nuclear power plants must comply with the minimum floodplain management criteria and appropriate Federal/State/local regulations, including the ESA and regulations concerning the use and disposal of hazardous materials and hazardous wastes. As such, implementation of the new ESA Guidance would not conflict with existing laws or policies concerning the regulation of hazardous materials and wastes or constitute a fundamental change in the quantity or type of hazardous wastes or materials; create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials; or create a hazard through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials.

Moreover, development of hazardous materials facilities would not be significantly affected by the new ESA policy/procedure because these facilities should already be in compliance with the ESA. However, because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to ascertain whether the change would increase the levels of ESA compliance in NFIP participating communities. FEMA can state that to the extent that a particular project would not otherwise comply with the ESA, the new guidance requirements could cause a delay in the permit approval process to develop in the floodplain for these infrastructure projects while documentation of such compliance is being obtained.

Furthermore, FEMA does not authorize, fund, or carry out floodplain development pursuant to the NFIP, nor does it encourage such floodplain development to occur. Therefore, implementation of these changes would not generate any new hazardous materials or wastes or constitute a fundamental change in the quantity or type of hazardous wastes or materials; create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous wastes and materials; or create a hazard through reasonably foreseeable upset and accident conditions involving the release of hazardous wastes or materials. In sum, there would be no direct impacts to existing hazardous wastes and materials resources from the implementation of the ESA guidance requirements.

4.2.6 Climate Change

4.2.6.1 Significance Criteria

CEQ guidance requires Federal agencies to consider climate change from the potential effects of the alternatives on climate change from an increase of greenhouse gas (GHG) emissions (CEQ, 2016). The effects of the alternatives on climate change from GHG emissions is considered significant if the alternative:

- Contributes to climate change due to direct or indirect GHG emissions (via quantitative analysis or if data inputs are not reasonably available through qualitative analysis).

CEQ guidance also requires Federal agencies to consider climate change effects on the affected environment and of alternatives. CEQ guidance on analyzed impacts from climate change is more general. The CEQ guidance identifies that the body of scientific information about climate change and more refined estimates of the impacts of climate change, both globally and locally, are evolving (CEQ, 2016). As a result, the CEQ guidance allows for qualitative analysis of the affects of climate change.

CEQ guidance states that Federal agencies should take into account the ways in which a changing climate may impact the proposed action and any alternative actions, change the action's environmental effects over the lifetime of those effects, and alter the overall environmental implications of such actions. Climate change and sea level rise affect the hazard that is reflected in updated maps.

Table 4-6 provides a summary of the potential climate change impacts.

Table 4-6: Potential Climate Change Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Contribution to climate change through direct or indirect GHG emissions.	No impact	No impact	No impact	No impact

4.2.6.2 Alternative 1 (No Action Alternative)

The NFIP makes Federal flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under the State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level through the community's floodplain management regulations and permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, and for reviewing the proposed development to ensure compliance with their floodplain management ordinances and that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP.

A study prepared for FEMA, *The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100,* was developed to assess the likely influence of climate change. Potential elements of climate change include more frequent and intense heat waves, more heavy precipitation events and flooding, increased drought, greater sea-level rise, and more severe weather events and intense storms. The study found that "for the riverine environment, the typical 1-percent-annual-chance floodplain area (i.e., the SFHA) nationally is projected to grow by about 45 percent, with very large regional variations. The 45 percent growth rate is a median estimate implying there is a 50 percent chance of this occurring" (AECOM, 2013). There are also no expected significant decreases in floodplain depth or area at the median estimates, and median flood flows may increase even in areas that are expected to become drier. "Within typical developed areas of primary interest for the NFIP, approximately 70 percent of these increases in flood discharge, SFHA, and base floodplain depth may be to the influence of climate change. Therefore, approximately 70 percent of the 45 percent (or 31.5 percent) growth in the 1-percent-annual-chance floodplain is due solely to climate change" (AECOM, 2013).

Additionally, "for the coastal environment, under the assumption of a fixed shoreline, the study found that the typical increase in the coastal SFHA is projected to also be about 55 percent by the year 2100. The 55 percent increase is a median estimate so there is a 50-percent chance of this occurring. Under the receding shoreline assumption, negligible change in the coastal SFHA is projected" (AECOM, 2013). Nationally, considering riverine and coastal floods together, the average increase in the SFHA by the year 2100 is projected to be about 40 or 45 percent, whether coastal recession is assumed or is not assumed (AECOM, 2013).

Considering these projected impacts, the study found that the economic impacts would include an increase in the number of NFIP riverine insurance policies by approximately 100 percent by 2100, and the number of coastal policies may increase by approximately 60 percent by 2100. The increase in the number of policies is due in part to normal population growth and in part to the effect of climate change on the size of the SFHA. (AECOM, 2013)

The study concludes that there will also be premium rate increases as a result of climate change. For the receding shoreline scenario, premium rates are "projected to increase as much as 40 percent in today's U.S. dollars by the year 2100 to offset the projected increase in loss cost" (AECOM, 2013). Under a fixed shoreline scenario, "[a]verage premium per policy for the fixed shoreline scenario would increase as much as 70 percent in today's U.S. dollars by the year 2100 in order to offset the projected increase in loss cost, corresponding to a cumulative increase of about 0.6 percent per year" (AECOM, 2013).

Additionally, under a fixed shoreline scenario, AECOM's study found that "the total number of NFIP policies may increase by approximately 100 percent by the year 2100, with the number of riverine policies increasing by about 80 percent and the number of coastal policies increasing by as much as 130 percent" (AECOM, 2013). The study further noted that a "greater number of coastal policies is the result of the enlargement of the SFHA caused by sea level rise" (AECOM, 2013).

Finally, the study found that "[t]he average loss cost per policy under this assumption may increase approximately 90 percent by the year 2100, with cumulative increases of about 10 percent to 15 percent through the year 2020 and 20 percent to 60 percent through the year 2080" (AECOM, 2013).

Under the No Action Alternative, FEMA would continue the policies and program elements of the existing NFIP. Continued implementation of the NFIP would not include any physical development or ground disturbance in the floodplain, nor would it encourage any development in the floodplain to occur. There would be no construction activities or other activities that would generate GHG emissions. As a result, there would be no contribution to climate change due to GHG emissions and there would be no impact to climate change through implementation of the No Action Alternative.

4.2.6.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders are policyholders whose residences were built prior to the community's first FIRM. Since nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that recently joined the NFIP. The likelihood of a project proponent making a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote.

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, such that these policies are actually more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, the monthly installment payment plan option is simply an administrative change to expand the payment options available to certain NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that couldcause or increase GHG emissions.

Implementing these legislatively required insurance changes would not cause or result in any development or construction activities. As a result, there would be no increase in GHG emissions. These program changes would not create new GHG emissions. Carbon dioxide, the most prevalent GHG emission, is generally created through the combustion of fossil fuels such as in the production of electricity. The implementation of legislatively required insurance changes could involve the use of general office equipment such as computers or printers that use electricity. However, these operations would not require additional use of this equipment outside of daily operations, and therefore would not impact climate change.

Under Alternative 2, current NFIP regulations would be clarified to expressly state that FEMA would require communities to obtain and maintain documentation of compliance with appropriate Federal or State laws, including the ESA, prior to the issuance of permits to develop in the floodplain per 44 C.F.R. § 60.3(a)(2). No new GHG emissions would be created from the clarification that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain.

The change clarifying that issuance of certain LOMC requests would be contingent upon the provision of documentation of compliance with the ESA would not increase GHG emissions nor would the action create new sources of GHG emissions. There would be no construction activities or GHG emission sources as a result of implementing this proposed clarification. Documentation requirements related to the implementation of this alternative could require some use of electronic equipment, but would not accelerate daily operations in such a way that would increase GHG emissions. Therefore, implementation of Alternative 2 would have no impact on climate change.

4.2.6.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the development of a monthly installment plan payment option would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.2.6.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, will be mitigated to the maximum extent possible. Additionally, under the ESA Regulatory Changes, current NFIP regulations would also be clarified to expressly state that the current exception to the no-rise performance standard would only apply to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. Also, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to NFIP communities placed on probation would be increased from $50 to $100. These actions would not increase existing or create new GHG emissions. FEMA does not authorize, fund, carry out, or encourage floodplain development under the NFIP so there are no impacts on emissions, and these actions would not affect climate change. Implementing these actions would not increase GHG emissions nor would the action create new sources of GHG emissions.

Documentation requirements related to the implementation of this alternative could require some use of electronic equipment, but would not accelerate daily operations in such a way that would increase GHG emissions. Therefore, implementation of Alternative 3 would have no impact on climate change.

4.2.6.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the implementation of a monthly installment plan payment option would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.2.6.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

For the ESA Guidance, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed. In addition, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private development in the floodplain was undertaken in compliance with the ESA. Documentation requirements related to the ESA Guidance could require some use of electronic equipment, but would not accelerate daily operations in such a way that would increase GHG emissions. Therefore, implementing the ESA Guidance would have no impact on climate change.

4.2.7 Historic and Cultural Resources

4.2.7.1 Significance Criteria

An evaluation of potential impacts to historic and cultural resources involves a comparison of current and future integrity of historic buildings and structures, or archaeological sites, and a determination of the extent to which the alternatives might affect their integrity.

There is the potential for adverse historic or cultural resource impacts to occur when an activity does not maintain the integrity and historic nature of a historic property, such as:

- Physically destroys, damages, or alters all or part of a historic property;
- Physically destroys, damages, alters, or removes items from archaeological contexts without a proper mitigation plan;
- Isolates a property from or alters the character of a historic property's setting when that character contributes to the property's qualification for the National Register of Historic Places;
- Introduces visual, audible, or atmospheric elements that are out of character with a historic property or alters its setting; or
- Causes loss of maintenance of a historic property resulting in its deterioration or destruction; or transfer, lease, or selling of the property (36 C.F.R. § 800.9(b)) without a proper preservation plan.[10]

This NPEIS analysis reviews the potential historic and cultural resource impacts for the alternatives. Table 4-7 provides a summary of the potential historic and cultural resource impacts.

[10] This bulleted list of example potential adverse impacts to historic and cultural resources was taken from 36 C.F.R. § 800.5(a)(2).

Table 4-7: Potential Cultural Resource Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Maintains the integrity and historic nature of a historic property	No impact	No impact	No impact	No impact

4.2.7.2 Alternative 1 (No Action Alternative)

The following assessment of the No Action Alternative addresses each of the significance criteria, highlighting the aspects of the current implementation of the NFIP that are most relevant to each of the criteria. This is because the NFIP has many aspects, only some of which are relevant to historic and cultural resources and appropriately addressed by application of the historic and cultural resources criteria. The action alternatives, in contrast, each include a limited number of components, so it is more appropriate to organize those evaluations by the components of the alternatives.

The No Action Alternative refers to the current implementation of the NFIP, and serves as a benchmark against which impacts of the various alternatives can be evaluated.

As described earlier, the three main components of the current NFIP are floodplain management, flood hazard mapping, and flood insurance. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. The sale of flood insurance is not an undertaking subject to Section 106 because FEMA does not have discretion to withhold the sale of flood insurance once a community has adopted floodplain management ordinances.[11] An analysis of effects on historic properties would not result in changes to this aspect of the program since the National Flood Insurance Act of 1968 (NFIA) states that FEMA "shall make flood insurance available" in States or areas that have indicated interest and have met FEMA's minimum criteria for adequate land use and control measures (see 42 United States Code [U.S.C.] § 4012(c)).

Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. NFIP mapping activities are not undertakings subject to Section 106. Section 106 is triggered when an agency's action has the potential to impact historic properties, and when the agency has the discretion to take into account factors such as the impact on historic properties in taking its action.[12] FEMA maps floodplains based on existing natural hazards and any technical and scientific data submitted (see 42 U.S.C. § 4101). The purpose of mapping is to accurately depict the floodplain. While mapping is a Federal action, the only factors that are considered in mapping the floodplain are technical and scientific

[11] Per 36 C.F.R. § 800.16(y), an undertaking constitutes "project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval."

[12] Per 36 C.F.R. § 800.16(l)(1), a historic property includes "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria."

data. The degree of discretion is limited to consideration of that data—the sole basis to challenge a FEMA floodplain map is the possession of technical data demonstrating that FEMA's determination was incorrect (see 42 U.S.C. § 4104(b)).

Even in the case of CLOMRs or CLOMR-Fs, when FEMA has an opportunity to comment on the impact to the floodplain of proposed construction, FEMA's discretion is limited to determining what effect the construction might have on the hazard of flooding. FEMA's authority under 44 C.F.R. § 65.8 limits it to "comments on whether a proposed project, if built as proposed, would justify a map revision." FEMA is limited to a "comment" and does not have any additional authority to require changes to the project. Therefore, FEMA mapping actions are not undertakings that trigger Section 106 consultation.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. The communities incorporate these minimum floodplain management criteria into community ordinances and regulations as a condition of participation in the NFIP. Floodplain management is carried out at the State and local levels, where land use authority resides. The community regulates development in the floodplain through locally issued permits, and the community has the authority to issue or deny permits for development in a floodplain. Likewise, each community monitors compliance and enforcement of individual permits. FEMA's only action is to determine whether the adopted ordinances meet FEMA's minimum standards. The community must then uniformly enforce its ordinances (see 44 C.F.R. § 60.1(b)). Floodplain development is not funded, permitted, licensed, or approved by FEMA pursuant to the NFIP, nor does the NFIP encourage such development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may occur in the floodplain.

The NFIP floodplain management regulations provide relief for historic structures. Historic structures are not required to meet certain floodplain management requirements as long as they maintain their historic structure designation. The NFIP allows for variances for historic structures. "Variances may be issued for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure" (see 44 C.F.R.§ 60.6(a)).

The application of the floodplain management criteria by the community is non-Federal and not an undertaking that would trigger Section 106 of the NHPA. The community adopts and enforces floodplain management regulations, whereas FEMA simply sets certain flood risk reduction-related minimum standards for how that development is carried out. In addition, FEMA's continuing oversight is limited to ensuring compliance with its regulations. Therefore, the community's issuance of permits does not constitute an undertaking. FEMA does not have any involvement or control in the community's application of its own regulations to a particular structure. In fact, a community may choose to implement more restrictive regulations than FEMA's minimum standards require.

Under the No Action Alternative, FEMA would continue the policies and program elements of the existing NFIP. Continued implementation of the NFIP is not considered an undertaking subject to Section 106; therefore, there would be no impact to historic properties.

4.2.7.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option. As stated in Section 4.2.7.2, the sale of flood insurance is not an undertaking subject to Section 106 because FEMA does not have discretion to withhold the sale of flood insurance once a community has adopted floodplain management ordinances. The NFIA states that FEMA "shall make flood insurance available" in States or areas that have indicated interest and have met FEMA's minimum criteria for adequate land use and control measures (42 U.S.C. § 4012(c)). Because the sale of flood insurance, including the price at which it is sold and the manner of payment allowed, is not considered an undertaking subject to Section 106, there would be no impact to historic properties as a result.

Under Alternative 2, changes would be made to clarify that, pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of the issuance of a permit to develop in the floodplain. As stated in the discussion of the No Action Alternative, the implementation of the floodplain management criteria by the community, including any guidance developed in support of that implementation, is a non-Federal action and therefore not an undertaking under Section 106 of the NHPA. Therefore, there would be no impact to historic properties.

Under Alternative 2, changes would be made to clarify that FEMA will now require documentation of ESA compliance as a condition of all map change requests. Alternative 2 does not impose any additional requirements or change any substantive aspects of the program related to aesthetic and visual resources. As stated in the discussion on the No Action Alternative, NFIP mapping activities, including any guidance developed in support of such mapping activities, are not undertakings subject to Section 106 consultation. Therefore, there would be no impact to historic properties as a result.

4.2.7.4 Alternative 3 (Legislatively Required Changes, ESA Regulatory Changes, and LOMC Clarification)

Because the legislatively required and LOMC clarification portions of Alternative 3 would be the same as those described under Alternative 2 (Section 4.2.7.3), which are not considered undertakings subject to Section 106, they do not warrant impact analysis. The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria, as described in 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, would be mitigated to the maximum extent possible. As stated in the discussion of the No Action Alternative, the implementation of the floodplain management criteria by the community, including any guidance developed in support of that implementation, is a non-Federal action and therefore not an undertaking under Section 106 of the NHPA. Therefore, there would be no impact to historic properties as a result.

Under the ESA Regulatory Changes, current NFIP regulations would also be clarified to expressly state that the current exception to the no-rise performance standard would only apply to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. As stated in the discussion of the No Action Alternative, the implementation of the floodplain management criteria by the community, including any guidance developed in support of that implementation, is a non-Federal action and therefore not an undertaking under Section 106 of the NHPA. Therefore, there would be no impact to historic properties as a result.

Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to NFIP communities that have been placed on probation would be increased from $50 to $100. An increase in the cost to property owners for flood insurance would not have a direct effect upon historic properties, and such a minimal increase in the cost to property owners is unlikely to have an indirect effect such as causing deferred maintenance of historic properties. Furthermore, because these actions would be administrative in nature, and would not cause or lead to any development within an existing floodplain that could, in turn, result in an effect to historic and cultural resources, this portion of Alternative 3 would not result in either a direct or indirect impact to historic and cultural resources.

4.2.7.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

Because the legislatively required and LOMC clarification portions of Alternative 4 would be the same as those described under Alternative 2 (Section 4.2.7.3), which are not considered undertakings subject to Section 106, no impact analysis is warranted. The impacts associated with the ESA Guidance portion of this alternative are described below.

Under Alternative 4, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed. Furthermore, if there are any potential adverse impacts to such species and habitat as a result of such development, the community must obtain and maintain documentation that private development in the floodplain was undertaken in compliance with the ESA. As stated in the discussion of the No Action Alternative, the implementation of the floodplain management criteria by the community, including any guidance developed in support of that implementation, is a non-Federal action and therefore not an undertaking under Section 106 of the NHPA. Therefore, there would be no impacts to historic properties as a result of this action.

4.2.8 Infrastructure

4.2.8.1 Significance Criteria

An evaluation of infrastructure impacts involves a comparison of current and future proposed infrastructure in the United States and a determination of the extent to which the alternatives might be incompatible with these uses. There is the potential for infrastructure impact to occur when an activity:

- Disrupts an existing or planned infrastructure service, such as flood control, transportation, utilities, or telecommunications.

This NPEIS analysis reviews the potential infrastructure impacts from the alternatives. Table 4-8 provides a summary of the potential infrastructure impacts.

Table 4-8: Potential Infrastructure Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Disruption of an existing or planned infrastructure service, such as flood control, transportation, utilities, or telecommunications	No impact	No impact	No impact	No impact

4.2.8.2 Alternative 1 (No Action Alternative)

The following assessment of the No Action Alternative addresses the significance criteria, highlighting the aspects of the current implementation of the NFIP that are most relevant to the criteria. This is because the NFIP has many aspects, only some of which are relevant to infrastructure and appropriately addressed by application of the infrastructure criteria. The action alternatives, in contrast, each include a limited number of components, so it is more appropriate to organize those evaluations by the components of the alternatives.

The intent of the NFIP is provide flood insurance to property owners in participating communities and to encourage flood risk reduction through the implementation of community floodplain management criteria. Communities participating in the NFIP incorporate these minimum floodplain management criteria into local ordinances and regulations. Through the NFIP, flood insurance is available for property owners in participating communities to protect their property against potential future flood losses. Furthermore, through the Flood Hazard Mapping Program (Risk MAP), FEMA identifies flood hazards and assesses flood risks for States and communities, which in an integral part of the NFIP.

While the NFIP is a Federal program, land use management in floodplains is the responsibility of State and local governments for how that development is carried out. Floodplain development activities permitted in the SFHA are authorized by local governments. Development in the floodplain cannot be dictated from the Federal level. FEMA has no legal authority under the NFIP to prohibit development within the floodplain. In addition, there is no requirement in the NFIP specifically limiting the location of critical facilities, including infrastructure for utilities such as electric power, potable water, and wastewater, as well as roads and bridges that provide essential links to critical facilities. However, NFIP floodplain regulations require that utilities, which include sewage management systems, be located and designed to minimize or eliminate flood damages.

Additionally, through the CRS, FEMA encourages communities and localities to establish ordinances prohibiting the construction of critical facilities within the 500-year floodplain. For instance, FEMA continues to encourage communities to adopt stronger building codes for all development in floodplains, especially critical facilities. By doing so, flood events can be minimized within the watershed, and thereby reduce costs for improving and maintaining existing infrastructure located in flood-prone areas and associated risk with these structures.

Since floodplains are naturally flat and occur along navigable waterways, these areas are often developed for transportation infrastructure and industrial and commercial purposes. Infrastructure systems, such as State highways, railways, and port facilities, will continue to be built and maintained in the floodway. The No Action Alternative would not require State or local governments to alter the management of existing infrastructure resources. The No Action Alternative would not disrupt existing or planned infrastructure service, such as flood control, transportation, utilities, or telecommunications. Based on the policies and program elements of the existing NFIP, the No Action Alternative would result in no impacts to infrastructure resources.

4.2.8.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

Phasing out subsidies on pre-FIRM properties under Alternative 2 could result in rising costs to affected properties or facilities, such as wastewater treatment plants, that are insured under the NFIP. However, given the rise in premiums is small in relation to overall operational costs for these affected facilities, the resulting financial impact to property owners and the value of properties would likely be minimal. Additionally, any increase in fees and/or service charges passed along to consumers would be negligible. The implementation of these legislatively required insurance changes would not result in disruptions or changes to existing or planned infrastructure service, such as flood control, transportation, utilities, or telecommunications. Therefore, there would be no impacts to existing infrastructure resources through implementation of this legislatively required insurance change.

Implementation of a monthly installment plan payment option for non-escrowed policyholders to pay for their flood insurance would not likely influence changes in planned infrastructure service. FEMA intends to add a monthly service fee to installment plan policies; therefore, these policies are actually more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of a more expensive installment plan policy would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. More importantly, because this change is solely an administrative change to the insurance payment options of NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could impact infrastructure, this change would have no impact on infrastructure. Because the installment plan would not disrupt, change or conflict with existing or planned infrastructure services uses, there would be no impacts to existing infrastructure resources through implementation of this legislatively required insurance change.

Under Alternative 2, current NFIP regulations would be clarified to expressly state that FEMA would require communities to obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, prior to the issuance of permits to develop in the floodplain per 44 C.F.R. § 60.3(a)(2). Infrastructure systems located within flood hazard areas already must comply with the ESA and appropriate Federal, State, and local regulations. As a result, this change would not disrupt an existing or planned infrastructure service. Therefore, implementation of the proposed clarifications to FEMA's floodplain management compliance documentation requirements would not affect existing or planned infrastructure service.

The clarification that issuance of certain LOMC requests would be conditioned upon documentation of compliance with the ESA does not impose any additional requirements associated with the nation's infrastructure. Infrastructure systems located within flood hazard areas already must comply with the ESA and appropriate Federal, State, and local regulations. As a result, this change would not disrupt the existing or planned infrastructure service. In sum, there would be no impacts to existing infrastructure resources through implementation of Alternative 2.

4.2.8.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the development of a monthly installment plan payment option would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.2.8.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge. While adoption of the ESA-related performance standard would not change the basic structure of the NFIP or increase FEMA's land use authority or influence in implementing the NFIP, it could encourage communities to take a more active role in ensuring floodplain development is ESA-compliant, which may, in turn, change or conflict with a community's existing or planned infrastructure services.

Under the ESA Regulatory Changes, FEMA would incorporate a new ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed floodplain development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, would be mitigated to the maximum extent possible. Infrastructure systems located within flood hazard areas, such as buildings, airports, and nuclear power plants, must comply with the minimum floodplain management criteria and appropriate Federal/State/local regulations, including the ESA. Since communities would have the option of satisfying the mitigation requirements of the new ESA-related performance standard through a Section 10 incidental take permit, or a Section 7 incidental take statement obtained through another Federal agency, any infrastructure projects that would already be in compliance with the ESA should not be effected by the new requirements. These requirements would not affect existing or planned infrastructure service.

However, because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to ascertain whether the change would increase the levels of ESA compliance in NFIP participating communities. FEMA can state that to the extent that a particular infrastructure project would not otherwise comply with the ESA, the new requirements under the ESA-related performance standard could cause a minor delay in the permit approval process to develop in the floodplain for these infrastructure projects while documentation of such compliance is being obtained. However, because such impacts would be limited to delays, and would not involve disruption of an existing or planned infrastructure service, implementation of the ESA-related performance standard would not affect existing or planned infrastructure service.

Under the ESA Regulatory Changes, current NFIP regulations would be clarified to expressly state that the current exception to the no-rise performance standard would only apply to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. This clarification would not alter existing or planned infrastructure systems including those located along floodways, such as dams, levees, port facilities, and utilities, since these projects are already in compliance with floodplain management requirements. According to FEMA's estimates, the number of non-public purpose projects that were built in the floodway due to the lack of clarification that would be provided under this alternative is 15 projects per year. However, given the fact that most infrastructure projects would qualify as public purpose projects, they are unlikely to be one of the estimated 15 affected projects. Therefore, based on the significance criteria presented in Section 4.2.8.1, there would be no impacts to existing infrastructure resources from the clarification of the no-rise performance standard.

Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to NFIP communities that have been placed on probation would be increased from $50 to $100. There would no construction activities from implementing this new probation surcharge. This change would not disrupt an existing or planned infrastructure service. This change could lead to higher flood insurance costs to affected properties or facilities that are insured under the NFIP. However, for any affected facilities, the resulting financial impact to property owners and the value of properties would likely be minimal because the rise in insurance policy costs are small in relation to overall operational costs. Additionally, any increase in operational costs passed along to consumers would be negligible. Therefore, there would be no impacts to existing infrastructure resources through implementation of this new probation surcharge.

4.2.8.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the development of a monthly installment plan payment option would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.2.8.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

For the ESA Guidance, FEMA would utilize the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private development in the floodplain was undertaken in compliance with the ESA. Infrastructure systems located within the SFHA, such as buildings, airports, and nuclear power plants, must comply with the minimum floodplain management criteria and appropriate Federal, State, and local laws, including the ESA. As such, infrastructure development should not be significantly affected by the new ESA policy/procedure since infrastructure projects should already be in compliance with the ESA.

However, because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to ascertain whether the change would increase the levels of ESA compliance in NFIP participating communities. FEMA can state that to the extent that a particular infrastructure project would not otherwise comply with the ESA, the new ESA Guidance requirements could cause a delay in the permit approval process to develop in the floodplain for these infrastructure projects while documentation of such compliance is being obtained. However, because such impacts would be limited to delays, and would not involve disruption of an existing or planned infrastructure service, implementation of Alternative 4 would not affect existing infrastructure.

4.3 RESOURCE AREAS WITH POTENTIAL IMPACTS

4.3.1 Socioeconomic Resources

4.3.1.1 Significance Criteria

An evaluation of impacts on socioeconomic resources involves examination of how an alternative affects specific aspects of the socioeconomic environment. An alternative would result in significant impacts on socioeconomic resources if it:

- Increases premium rates for policies covering residential buildings in the SFHA by greater than or equal to 18 percent[13] annually for 10 percent or more of all housing units in SFHAs;[14, 15]
- Increases premium rates for commercial policies by greater than or equal to 18 percent[16] annually for 5 percent or more of the total of NFIP policies;[17]
- Affects other economic characteristics (employment or tax revenues) in a way that alters local economies on a substantial basis;
- Changes housing characteristics (types of units, occupancy, housing values, etc.) or residential development patterns in a substantial way;
- Alters population growth or demographic patterns in ways that change the overall character of communities;
- Requires an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions or the viability of proposed projects;
- Alters ecosystem services (benefits to the human population derived from natural system functions) in a substantial way;

[13] FEMA uses 18 percent as the magnitude threshold because Congress gave prominence to this figure in HFIAA as a level of increase that no individual policy (or other policy not subject to the mandatory 25 percent premium rate increase provision) should exceed annually. FEMA uses 10 percent as the prevalence threshold because it means, conversely, that 90 percent (the vast majority) of the "universe" of potential policyholders (all housing units in the SFHA) would not be affected this way.

[14] There are differences in the FEMA and U.S. Census Bureau data that must be considered analyzing the impacts of the alternatives under this criterion. The U.S. Census Bureau defines a housing unit as:
…a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied, or, if vacant, is intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants live separately from any other persons in the building and which have direct access from the outside of the building or through a common hall (U.S. Census Bureau, 2013a).

Under this definition, a single-family house counts as one housing unit, a duplex house counts as two housing units, and an apartment building with five apartments counts as five housing units.

FEMA's residential policy statistics are broken down into three occupancy categories. Occupancy 1 policies cover single-family buildings and single-family residential units within other buildings. Occupancy 2 policies cover residential buildings containing 2-4 residential spaces. Occupancy 3 policies cover residential buildings with residential space for 5 or more families. Appendix E contains precise definitions. The concepts of residential units and residential spaces in FEMA's definitions are functionally equivalent to the U.S. Census Bureau's definition of a housing unit. FEMA does not have counts of the number of residential units or spaces covered by FEMA policies for the Occupancy 2 and 3 categories. Therefore, it is not possible to exactly compare housing units covered by FEMA policies to the total number of housing units in the SFHA (the number provided by the U.S. Census data). The analysis below further discusses these differences and how they affect the results.

[15] This means: If the alternative in question causes the number of residential policies in the SFHA for which premium rates are increased by greater than or equal to 18 percent annually to exceed 10 percent or more of total housing units in the SFHA (as defined by the U.S. Census Bureau), it is significant for the purpose of this environmental analysis.

[16] FEMA uses the 18 percent magnitude threshold for the reason noted above. FEMA uses a lower prevalence threshold for this criterion because the reference population is not limited to potential policyholders in the SFHA, as it is for residential policyholders. The number of potential commercial policyholders in the SFHA is not known.

[17] This means: If the alternative in question causes the number of commercial policies for which premium rates are increased by greater than or equal to 18 percent annually to exceed 5 percent of total NFIP policies, it is significant for the purpose of this environmental analysis.

- Substantially compromises the ability of communities to provide public health and safety services; or
- Results in disproportionately high and adverse human health or environmental (including economic) effects on minority populations or low income populations.

Table 4-9 provides a summary of the potential impacts on socioeconomic resources. The No Action Alternative refers to the current implementation of the NFIP as described in Section 2.3. As such, the significance criteria are applied to the No Action Alternative in a general sense; that is, in comparison to the socioeconomic environment that would likely exist in the absence of the NFIP. For instance, the criterion for Impacts on Population Growth or Demographic Patterns is applied by evaluating the degree to which the NFIP may alter population growth when compared to growth patterns that would probably exist in the absence of the NFIP. The No Action Alternative also serves as a benchmark against which impacts of the action alternatives (Alternatives 2, 3, and 4) can be evaluated. The significance criteria are applied to the action alternatives in comparison to the No Action Alternative; for instance, by reviewing how Alternative 2 would alter population growth in comparison to the continuation of the NFIP as currently implemented (the No Action Alternative).

Additionally, it is important to note that although Federal law requires the purchase of flood insurance as a condition of receiving Federally backed loans and Federal assistance in the SFHA (see Section 4.1.1.1), this flood insurance purchase requirement is not part of the NFIP program and nothing in the analysis below should suggest otherwise. However, the analysis below accepts the fact that there is such a requirement and analyzes the effects of the provision of flood insurance and the increases to premium rates in light of the fact that this requirement exists.

Table 4-9: Potential Socioeconomic Resources Impact Summary

Impact Criteria	Alternative 1 (No Action)	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Impacts on Economic Characteristics (Costs of Flood Insurance)	Less than significant	Less than significant	Less than significant	Less than significant
Impacts on Economic Characteristics (Employment or Tax Revenues)	Less than significant	Less than significant	Less than significant	Less than significant
Impacts on Housing Characteristics	Less than significant	Less than significant	Less than significant	Less than significant
Impacts on Population Growth or Demographic Patterns	No impact	No impact	No impact	No impact
Impacts on Public or Private Resources	Less than significant	Less than significant	Less than significant	Less than significant
Impacts on Ecosystem Services	Less than significant beneficial	No impact	Less than significant	No impact
Impacts on Public Health and Safety Services	Less than significant beneficial	No impact	No impact	No impact
Impacts on Environmental Justice	Less than significant	Less than significant	Less than significant	Less than significant

4.3.1.2 Alternative 1 (No Action Alternative)

The following assessment of the No Action Alternative addresses each of the significance criteria, highlighting the aspects of the current implementation of the NFIP that are most relevant to each of the criteria. This is because the NFIP has many aspects, only some of which are relevant to socioeconomics and appropriately addressed by application of the socioeconomic criteria. The action alternatives, in contrast, each include a limited number of components, so it is more appropriate to organize those evaluations by the components of the alternatives.

4.3.1.2.1 Impacts on Economic Characteristics (Costs of Flood Insurance)

Flood insurance premiums, and additional provisions of the NFIP that affect total flood insurance costs such as the Reserve Fund Assessment, the Homeowner's Flood Insurance Affordability Act of 2014 (HFIAA)-imposed surcharge on NFIP policies, and the Federal Policy Fee clearly have socioeconomic implications. They are direct costs to policyholders, and represent an opportunity cost: income spent on flood insurance cannot be spent on other economic goods and services.

According to FEMA data, the average annual pre-FIRM subsidized policy premium growth rate in the five years preceding Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12) (2008 to 2012) was 6.82 percent. The growth rate ranged from 2.7 to 9.7 percent as shown in Table 4-10 (see Appendix F) (FEMA, 2016i). Premiums would continue increasing under the No Action Alternative.

Table 4-10: Pre-FIRM Premium Growth Rates Prior to BW-12

Year	Pre FIRM Premium Growth Rate
2008	7.5%
2009	9.7%
2010	2.7%
2011	5.2%
2012	9.0%
TOTAL	6.82%

Sources: (FEMA, 2016i)

Clearly, the No Action Alternative would have an impact on the costs of flood insurance[18] because premiums would continue increasing at rates similar to those shown above. However, to be significant, flood insurance premiums must increase greater than or equal to 18 percent annually. While some policies might be affected at this level, given the relatively low average increase values shown above, it is highly unlikely that the prevalence thresholds of the criteria (10 percent of all housing units in the SFHA for residential policies, and 5 percent of all NFIP policies for commercial policies) would be met in future years absent any major changes to the program. Therefore, the impact of the No Action Alternative on Economic Characteristics (Costs of Flood Insurance) is considered less than significant.

[18] Flood insurance premiums are only one part of the total cost of flood insurance, which also includes the HFIAA surcharge, the Federal Policy Fee, and any applicable probation surcharge.

It is important to note that paying for flood insurance also provides benefits to policyholders. These include reimbursement for flood damage losses if and when incurred, and less obvious benefits such as access to loans and other Federal assistance (for example, all federally backed mortgages require the purchase of flood insurance).

4.3.1.2.2 Impacts on Economic Characteristics (Employment or Tax Revenues)

Flood insurance premiums and other flood-insurance costs paid by NFIP policyholders affect spending in the local and regional economies. About 44 percent of policyholders' premiums are used to pay for current losses. Approximately 17 percent are used to pay interest or current debt or to build a cash reserve to pay claims for future losses (FEMA, 2011). All these funds leave the local economy. These funds (excepting interest and current debt payments) eventually re-enter local economies when losses are reimbursed, but only in the local economies where losses occur. Approximately 27 percent of policyholders' payments accrue to the NFIP Write-Your-Own (WYO) insurance carrier (FEMA, 2011), as compensation for services rendered. This compensation covers all direct expenses in servicing policies, overhead, and other expenses. Expenditures by WYO carriers generate income to other businesses, and the carriers also pay their employees, who in turn make their own expenditures. Money continues to recirculate many times in the local or State economy (WYO carriers must be located in the State of the serviced policy), supporting additional business income and employment in an economic phenomenon known as the "multiplier effect" (Miller & Blair, 2009). The amounts of money leaving or recirculating in local or State economies due to flood insurance payments are modest in absolute terms, and small in relative terms when compared to the total economy of a community or State. For instance, Vermont has the smallest economy among all of the States. As of July 2016, it had $5.2 million (M) of written flood insurance premiums in force (FEMA, 2016f). This constituted less than two one-hundredths of one percent of the State's annual gross domestic product of $31.2 billion (B) as of March 2016 (U.S. Bureau of Economic Analysis, 2016).

Flood insurance supports property values by ensuring property can be rebuilt or replaced if damaged by a flood. On the other hand, the costs of flood insurance represent an additional expense of property ownership for property owners in the SFHA—where flood insurance is a requirement of all federally backed mortgages—as compared to properties outside the SFHA, which are not subject to a flood insurance purchase requirement (but may voluntarily elect to purchase flood insurance). This additional cost of property ownership may be capitalized into, and thereby reduce, property value (National Research Council of the National Academies, 2015a). The magnitude of the effect would depend on several local and regional factors such as the affordability of housing, housing market conditions, the cost of insurance, and the percentage of the premium compared to the property value. Using Vermont as an example, a rough calculation is as follows. As of July 2016, Vermont had $5.2M of written flood insurance premiums in force (FEMA, 2016f). If all of these premiums are capitalized into property value at a 5 percent discount rate, the reduction in property value would be $104.6M. This constitutes 0.22 percent of the total owner-occupied residential property value in Vermont in 2015 of $47.4B (U.S. Census Bureau, 2016a). This result, 0.22 percent, actually overstates the impact on property value, because while the total premiums include all residential and commercial policies, the total property value figure does not include the value of renter-occupied residential properties and the value of commercial properties.[19]

Reductions in property value reduce the property tax base, and thereby reduce property tax revenues of local and State governments that charge property taxes. Effects on property taxes would be commensurate with (of roughly the same proportion as) the reductions in property values.

The literature suggests an alternative view of the effects of flood insurance on property values and tax revenues. It is well established that a property located in a floodplain has a lower property value than a similar property outside the floodplain. Various studies have estimated that the average reduction in value ranges from 4 to 12 percent. Most such studies have also found that the reduction in value due to location in a flood zone is more than the capitalized cost of flood insurance premiums, indicating perceptions of non-insurable costs associated with flooding may be built into property values. This differential between property value reductions and capitalized premiums is particularly notable for areas that have experienced recent flooding, which indicates that awareness of flood risk is a factor in property value. (Bin & Polasky, 2003)

Thus, reductions in property value actually experienced in the property market are mainly or entirely attributable to location in a flood zone, not to the flood insurance that is purchased to reduce losses should a flood occur. However, in cases where capitalized premium costs exceed the reduction in value that is directly attributable to a property's location in a flood zone, those premium costs may result in additional reductions in value. Such cases would be rare. Therefore, the impact of the No Action Alternative on economic characteristics (employment or tax revenues) is considered less than significant.

4.3.1.2.3 Impacts on Housing Characteristics

The significance criterion for this aspect of socioeconomic resources is "Changes housing characteristics (types of units, occupancy, housing values, etc.) or residential development patterns in a substantial way." With respect to development patterns, the NFIP is sometimes perceived, based on anecdotal evidence, as encouraging development in the floodplain, on the theory that it reduces the financial risk to property owners and communities from potential flood disasters through relatively low-cost property insurance (Rosenbaum & Boulware, 2006). Appendix C, NFIP Biological Evaluation, presents a variety of evidence (some of it summarized in Section 4.1.1) demonstrating that development in the nation's floodplains is driven by other factors. The following paragraphs summarize this evidence.

Historically, people have been attracted to water as places for living, industry, and commerce. Furthermore, even after natural disasters destroyed communities, damaged crops, and caused deaths, communities continually chose to rebuild in the floodplain, long before the availability of flood insurance. In recent decades, development along waterways and shorelines—areas within floodplains—has been spurred by the aesthetic and recreational value of these locations (Rosenbaum & Boulware, 2006).

The evidence indicates that the primary factors influencing development are economic factors, including the availability of jobs; proximity to ports, tourism and recreation amenities; infrastructure availability; and proximity to natural resources and existing communities. For instance, a study by the GAO found

[19] There is no nationally consistent source for total property value by political jurisdiction.

that the NFIP provides only "a marginal added incentive for development in coastal and barrier island communities" (Comptroller of the United States, 1982). The study found:

> "The primary reason for this development is desirability of the location for retirement and recreation purposes. Other factors promoting development include the availability of a community infrastructure, the availability of capital, and the viability of the local economy." (Comptroller of the United States, 1982)

Development of the floodplain was already well established prior to the inception of the NFIP. For instance, as reported in the FEMA *Floodplain Management Losses Avoided Study*, more than half (57 percent) of residential properties located in SFHAs were built prior to the inception of the NFIP (Congressional Research Service, 2013) (FEMA, 2014). As such, it is clear that development has occurred, and would continue to occur, in the SFHA even in the absence of flood insurance.

Studies have examined development patterns since the inception of the NFIP. In 1982, the GAO analyzed floodplain development data both before and after a community entered the NFIP. Generally, the communities were growing before their entrance into the program from 1960 to 1970, and this rate of growth continued from 1970 to 1980. The GAO found that annual increases and decreases in new housing units authorized generally paralleled the rise and decline of total housing units authorized in the nation and are more directly related to the state of the economy than the availability of flood insurance (Comptroller of the United States, 1982). A 2005 report examined floodplain development in areas where flood insurance is available compared to areas in which it is not available (e.g., CBRS units). The report found that many CBRS units have been developed, often quite extensively, despite the absence of NFIP flood insurance. The report further found that market forces appear to be an increasingly potent source of developmental pressure on CBRS units as undeveloped coastal barrier land becomes increasingly scarce (AIR - Rosenbaum, W., 2005).

- Furthermore, as discussed in Section 4.1.1.2 and the ecosystem services section below, there is some evidence that the NFIP discourages development in the SFHA through its floodplain management and flood hazard mapping activities (Rosenbaum & Boulware, 2006). Nevertheless, studies have shown that development is likely to be displaced to non-floodplain locations, generally within the same community, rather than foregone altogether. This was considered the likely outcome of floodplain regulations at least as early as the 1981 FEMA study, *Evaluation of the Economic, Social and Environmental Effects of Floodplain Regulations* (FEMA, 1981). The conclusion of that study was based on projected impacts of different regulatory scenarios on future development in 21 case study communities across the nation. This conclusion held even in communities with developable land constraints (e.g., steep topography).
- Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. The NFIP may discourage such development, but typically development would still occur within the same community, or nearby. Given these considerations, the impact of the No Action Alternative on residential development patterns is considered less than significant.
- With respect to housing characteristics, housing value was addressed in the previous section because of its relationship to tax revenues. Other housing parameters (types of units, occupancy, etc.) reflect overall development patterns. In general, development increases population, population growth

increases demand for housing, and higher demand tends to increase occupancy and property value (subject to the balance of supply and demand). These factors also tend to increase density—developers often change housing characteristics as demand and property values increase; for instance, by decreasing lot sizes and building more multi-family apartment and condominium units. Proximity to amenities, such as central business districts, shopping, schools, recreational areas, open space, and to areas of employment adds value to property and increases the demand to develop these parcels (Burby, et al., 1988). Availability of utilities is also key: areas with existing utilities tend to experience additional development, more than areas where utilities have yet to be installed (Asabere & Harvey, 1985) (Burby, et al., 1988) (Scott, 1989).

In short, housing characteristics are a product of market forces. Further, as described above, other factors besides the availability of flood insurance drive floodplain development. In addition, NFIP flood insurance is available for all types of buildings, so it does not skew the market toward particular types of units. Therefore, the impact of the No Action Alternative on housing characteristics is considered less than significant.

4.3.1.2.4 Impacts on Population Growth or Demographic Patterns

The significance criterion for this aspect of socioeconomic resources is "Alters population growth or demographic patterns in ways that change the overall character of communities." Population and demographic patterns in America's communities are driven by larger economic forces such as economic differences between rural and urban areas that drive young people to disproportionately migrate from the former to the latter (Shah, 2014) and migration to the southern "Sun Belt" States due to their generally better economic performance in recent decades (Kotkin, 2011). Within a small area, such as a county, people tend to move for housing-related reasons, while job-related reasons tend to be more important for longer distance movers (Ihrke, 2014). Larger social forces play a significant role in both migration and the changing demographic make-up of communities. These forces include the aging population of the nation (Ortman, Velkoff, & Hogan, 2014). They also include the increasing diversity in the United States' population, international in-migrations, the considerably increased presence of women in the labor force in recent decades, and changes in family structure such as the declining rate of two parent households (Cohn & Caumont, 2016). The available evidence and studies demonstrate that these factors, and not the NFIP, drive population growth and demographic patterns. As such, the NFIP and No Action Alternative are considered to have no impact on population growth or demographic patterns.

4.3.1.2.5 Impacts on Public or Private Resources

The significance criterion for this aspect of socioeconomic resources is "Requires an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions or the viability of proposed projects." To participate in the NFIP, a community must adopt and enforce floodplain management regulations that meet the NFIP floodplain management criteria. Communities may undertake floodplain management activities that exceed the minimum NFIP standards, and thereby may obtain discounts on flood insurance premiums for their participating residents and businesses through the NFIP's CRS program (FEMA, 2016b). Discounts range from 5 to 45 percent. Participation in the NFIP and the CRS requires communities to expend staff time and public funds to adopt required provisions and administer the necessary programs. In addition, participation requires some time and/or money expenditures by private parties. For instance, property owners must take the time to understand and choose flood insurance options. Developers must follow certain procedures for their projects to be compliant with NFIP minimum floodplain management requirements.

The amounts of resource expenditures undoubtedly vary across communities and private parties. There is competition for resources in most communities and companies, and funds used to comply with requirements based on participation in the NFIP could displace other potential uses for resources. However, because communities have the ability to pass on the cost of participation in the NFIP to project proponents through the permitting process to develop in the floodplain, the public sector fiscal impact of participation in the NFIP is negligible. In the private sector, developers only pursue a project if they think the potential rewards of expenditures on that project are greater than the rewards from alternative uses of their resources. In that context, complying with NFIP requirements (directly or to meet community standards), including the costs of obtaining a permit to develop in the floodplain from the community, is simply a cost of business. Based on these considerations, FEMA cannot conclude that the resource requirements "*substantially* interfere with the performance of other local government functions or the viability of proposed projects." Therefore, the impact of the No Action Alternative on public or private resources is considered less than significant.

4.3.1.2.6 Impacts on Ecosystem Services

Natural floodplains typically provide flood protection functions such as absorbing and spreading water and absorbing and attenuating wave energy. These and other ecosystem services provide economic and other values to people and communities. As described in Section 4.1.1, the NFIP does not cause development to occur, and does not facilitate or encourage floodplain development.

Therefore, in terms of negative impacts on ecosystem services, the No Action Alternative would not adversely alter ecosystem services (benefits to the human population derived from natural system functions) in a substantial way−because it does not involve any floodplain development or other activities that would negatively impact ecosystem services. Any adverse impacts are considered less than significant.

Moreover, although the No Action Alternative may have some beneficial impacts on ecosystem services, these do not constitute a substantial alteration. The NFIP regulates and discourages development in the SFHA through its floodplain management and flood hazard mapping activities, as noted in Section 4.1.1.2. The NFIP minimum floodplain management criteria do not require communities to prohibit development in the floodway, but they do require participating communities to ensure that development is done in such a manner that it does not result in an increase in flood heights. Under the CRS, NFIP participating communities can adopt more stringent standards and thereby obtain discounts on flood insurance premiums for their residents. The CRS standards include measures like preserving open space and natural areas and additional regulation of development in the floodplain. A 2006 AIR report found that in many communities, the NFIP has often restrained development in high-hazard floodplains (AIR - Monday et al., 2006). As explained in Section 3.4.4, under the minimum criteria, or the heightened standards used in CRS communities, communities may choose to reduce the extent of development in the floodplain. When they do this, they typically preserve some of the natural systems that provide ecosystem services such as the flood protection functions noted above. Thus, the NFIP may help protect floodplain related ecosystem services. In summary, the impact of the No Action Alternative on ecosystem services is considered less than significant and beneficial.

4.3.1.2.7 Impacts on Public Health and Safety Services

Public health and safety services, such as hospitals, police, and fire services, are a significant factor in the quality of life in a community. The significance criterion for this aspect of socioeconomic resources is "Substantially compromises the ability of communities to provide public health and safety services." One purpose and effect of the NFIP is to reduce potential losses of life and property through effective management of the floodplain. Reducing loss of life or flood-related injuries reduces burdens on public health and safety services to some degree. Therefore, the impact of the No Action Alternative on public health and safety services is considered less than significant, and beneficial.

4.3.1.2.8 Impacts on Environmental Justice Populations

The criteria for identifying significant environmental justice impacts is if the action results in disproportionately high and adverse human health or environmental (including economic) effects on minority populations or low income populations.[20] The impacts must be adverse, and they must occur disproportionately to such impacts on the general population.

With respect to the No Action Alternative, the relevant question is whether the provision of flood insurance has disproportionate and adverse effects on minority and low income populations. Relevant to that question is the issue of whether minority and low income populations are disproportionately located in flood zones.

With respect to the issue of whether minority and low income populations are disproportionately located in flood zones, some researchers hypothesize that "the theory of disproportionate impact applies, which states that a risk-based allocation of resources will disadvantage vulnerable communities" (Nance, 2015). However, this issue has not been settled by research to date. Maantay and Maroko (2009), citing three earlier studies, state that "historical settlement patterns influence the socio-demographic characteristics of populations residing in flood-prone areas. The development of low-elevation areas for housing and the desirability of coastal living have varied over time and place. Even within any given city, there may not be uniformity in the relationship between socioeconomic status and elevation." They go on to evaluate, using tax-lot level data, the presence of minority populations in flood zones (the 100-year floodplain, or SFHA) within New York City. They conclude:

> …the non-Hispanic black population within the flood zones was nearly 60 percent higher than expected in Manhattan, 40 percent higher than expected in the Bronx, and almost 100 percent higher in Queens. Non-Hispanic White populations, on the other hand, were over-represented by approximately 100 percent above expected in the flood zones in the Bronx, and 40 percent above expected in Brooklyn.

[20] FEMA follows EPA's *Policy on Environmental Justice for Working with Federally Recognized Tribes and Indigenous Peoples*. Therefore, federally recognized tribes and indigenous peoples are considered in the environmental justice analyses.

> Although there are instances of significantly disparate risk in Queens, the Bronx, and to a lesser degree Manhattan, there is no consistency between boroughs regarding the risk of flood exposure and race/ethnicity. Various other statistical tests were performed (e.g., chi square and Kramer's Phi) showing generally inconclusive environmental justice results in terms of the disproportionate impact of floods on communities of color.
>
> The inconsistent results regarding environmental justice impacts are likely due to a number of factors: variations amongst the boroughs' historic patterns of residential settlement; different levels and chronology of industrial development along the waterfront; recent and historic landfilling of coastal wetland areas, which subsequently enabled development at different times; recent de-industrialization efforts and gentrification in certain areas of the city; and cultural changes over the years concerning the desirability of living along the waterfront and therefore the flood zones. (Maantay & Maroko, 2009)

As stated above, the germane question for the No Action Alternative is really whether the provision of flood insurance—not the occurrence of flood events—has disproportionate and adverse effects on minority and low income populations. It is highly unlikely that the provision of flood insurance has significant adverse impacts on such populations because (a) flood insurance offers a benefit by reducing the exposure of such populations to potential economic losses associated with flooding and (b) all adverse impacts identified in the analyses above were less than significant. Low income populations may be less able to afford flood insurance than more affluent populations. FEMA's current analytical efforts, including collaboration with the U.S. Census Bureau, to develop an affordability framework as required by Congress[21] will provide additional data regarding any such effects and possible approaches to reducing those effects. Given these considerations, and based on the available studies and research, FEMA has determined that the No Action Alternative has a less than significant impact on environmental justice.

4.3.1.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification)

Alternative 2 includes multiple legislatively required components related to flood insurance, along with several other components. Two of the legislatively required components address phasing out subsidies on pre-FIRM properties, and the socioeconomic impacts of these components are addressed together in the first subsection below. A third legislatively required component involves the implementation of a monthly installment plan payment option, which is addressed in a separate subsection. Additional subsections address the other components of this alternative: one that would use floodplain management criteria guidance to clarify documentation requirements of communities when they issue permits to

[21] Section 9 of HFIAA states that "the Administrator shall prepare a draft affordability framework that proposes to address, via programmatic and Regulatory Changes, the issues of affordability of flood insurance sold under the National Flood Insurance Program, including issues identified in the affordability study required under Section 100236 of the Biggert-Waters Flood Insurance Act of 2012." The affordability study refers to two reports prepared by the National Research Council of the National Academies (2015b; 2015a).

develop in the floodplain and one that would clarify ESA-related documentation requirements for the issuing of certain LOMCs.

The subsections below assess the effects of the components of Alternative 1 against the various significance criteria. The effects on the environmental justice criterion are addressed in a specific subsection.

4.3.1.3.1 Legislatively Required Change: Phase-Out of Subsidies

The first component of Alternative 2 would phase out subsidies on certain pre-FIRM properties at a rate of 25 percent premium rate increases per year. Specifically, this would affect the following pre-FIRM properties: non-primary residences, business properties, severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property.

The second component of Alternative 2 would phase out subsidies on all other pre-FIRM properties through annual premium rate increases of an average rate of at least 5 percent, but no more than 15 percent, per risk classification, with no individual policy exceeding an 18 percent premium rate increase.[22] This would affect all policies not already subject to 25 percent rate increases or immediate removal of subsidies. (An example of the latter instance occurs when lapsed policies are reinstated.) Based on the range of policy types encompassed by the first component of Alternative 2, this second component primarily affects primary residence policies.

For both components, the premium rate increases would continue until the full-risk actuarial rate is reached (if known) on a specific policy, or until the submission of an elevation certificate accurately determines the full-risk rate. FEMA currently does not have sufficient information to determine the full-risk actuarial rate for every pre-FIRM subsidized policy (in particular, because many such policies do not have certified elevation certificates). Therefore, FEMA cannot automatically stop the premium rate increases on each policy once the full-risk rate is reached because the full risk rate is not known. In many cases, policyholders will have to obtain and submit elevation certificates in order for the appropriate full-risk rate to be determined.

It is important to note that FEMA is already several years into implementation of these two components, based on the requirements of BW-12 and HFIAA. Absent new Congressional direction, FEMA does not intend to alter this course. However, FEMA is developing an affordability framework as required by HFIAA, the results of which could inform the pace of premium increases under the second component of this alternative.

FEMA's Flood Insurance Manual provides the following definitions of the property classes affected by these components of Alternative 2 (FEMA, 2016c):

> **Primary Residence.** A single-family building, condominium unit, apartment unit, or unit within a cooperative building that will be lived in by the policyholder or the policyholder's spouse for:

[22] This cap on premium rate increases is subject to certain limited exceptions stated in statute.

1. More than 50 percent of the 365 calendar days following the current policy effective date; or

2. 50 percent or less of the 365 calendar days following the current policy effective date if the policyholder has only one residence and does not lease that residence to another party or use it as rental or income property at any time during the policy term.

A policyholder and the policyholder's spouse may not collectively have more than one primary residence.

Primary Residential Property. Either a primary residence or the contents within a primary residence, or both.

Non-Primary Residence. A residential building that is not the primary residence of the policyholder.

Non-Primary Residential Property. Either a non-primary residence or the contents within a non-primary residence, or both.

Severe Repetitive Loss Building. Any building that:

1. Is covered under a Standard Flood Insurance Policy made available under this title;

2. Has incurred flood damage for which:

   a. Four or more separate claim payments have been made under a Standard Flood Insurance Policy issued pursuant to this title, with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or

   b. At least two separate claims payments have been made under a Standard Flood Insurance Policy, with the cumulative amount of such claim payments exceed the fair market value of the insured building on the day before each loss.

Severe Repetitive Loss Property. Either a severe repetitive loss building or the contents within a severe repetitive loss building, or both.

Substantially Damaged Building. A building that has incurred damage of any origin whereby the cost of restoring the building to its before damaged condition would equal or exceed 50 percent of the market value of the building before the damage occurred.

Substantially Damaged Property. Either a substantially damaged building or the contents within a substantially damaged building, or both.

Substantially Improved Building. A building that has undergone reconstruction, rehabilitation, addition, or other improvement, the cost of which equals or exceeds 50 percent of the market value of the building before the "start of construction" of the improvement. This term does not include a building that has undergone reconstruction, rehabilitation, addition, or other improvement related to:

1. Any project or improvement of a building to correct existing violations of a State or local health, sanitary, or safety code specifications that have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions; *or*

2. Any alteration of a "historic building," provided that the alteration will not preclude the structure's continued designation as a "historic building."

Substantially Improved Property. Either a substantially improved building or the contents within a substantially improved building, or both.

Anecdotal evidence of socioeconomic impacts from phasing out NFIP subsidies has been presented in the popular press since the passage of BW-12; see, for instance, the New York Times (2015). The potential for and nature of impacts has also been addressed in studies by government and academic organizations (GAO, 2016) (National Research Council of the National Academies, 2015a) (National Research Council of the National Academies, 2015b). Based on the literature, potential socioeconomic impacts—some beneficial, some adverse—of this component include:

- Direct cost effects on policyholders,
- Reductions in property values,
- Impacts on lessees of policyholders,
- Impacts on community vitality and resilience,
- Indirect economic impacts on income and jobs, and
- Effects on the NFIP and Federal taxpayers.

The material below addresses each of these potential impacts in turn and considers geographic variations in impacts.

4.3.1.3.1.1 Direct Cost Effects on Policyholders

Phasing out subsidies by increasing flood insurance premium rates would have a direct impact on the finances of the affected policyholders. For most pre-FIRM subsidized policyholders, annual costs for maintaining flood insurance on their affected properties would increase relative to the status quo.[23] This represents an increase in the total cost of property ownership and thereby reduces the amount of the

[23] As noted in the discussion of Alternative 1 (No Action Alternative), the average annual pre-FIRM policy premium growth rate in the five years preceding BW-12 (2008 to 2012) was 6.82 percent, and ranged from 2.7 to 9.7 percent. Under the second component of Alternative 2, premium rate increases could be between 5 and 15 percent (primarily for primary residence policies). Depending on the actual premium rate increase FEMA adopts each year under Alternative 2, some policyholders may experience a smaller percentage increase than they did in the period before BW-12.

property owner's household or business income available for other uses.[24] In addition, many policyholders would face a one-time cost to obtain an elevation certificate to determine their appropriate full-risk rate and thereby avoid indefinite annual increases in their premium rates, which could lead to paying more than the full-risk rate. Each of these effects—of increased premium rate costs and of elevation certificate costs—is discussed in turn in subsections below.

Effects of Increased Premium Rate Costs

The impact of premium rate increases on each affected property owner's finances—specifically, the owner's overall income and expenditures cash flow—depends on multiple factors, including:

- How much flood insurance coverage they carry and their deductible;
- The differential between their current rate and the applicable full-risk rate;
- How quickly the subsidized premium rate reaches the full-risk rate and how quickly the policyholder obtains an elevation certificate that can be used to ascertain their full-risk rate; and
- Their ability to absorb the premium rate increase, or in the case of building owners who lease their property or businesses, their ability to pass on the premium rate increase to their lessee(s) or customers, respectively.

Under the NFIP, residential property owners can carry up to $250,000 of flood insurance coverage for buildings, and $100,000 for contents. Flood insurance does not cover the value of the underlying land, which is often a substantial portion of property value, and in many cases a flood would be unlikely to require replacement of an entire building. For these reasons, the amount insured may be substantially less than the current market value of a property. A similar logic applies to commercial property owners (business and multifamily properties); however, the limits on coverage are higher: $500,000 per building and $500,000 for the contents of the building owner. Tenants can separately obtain coverage for their contents. The lower the amount insured, the less the current premium would be, other factors being equal (FEMA, 2016d) (FEMA, 2016e). Therefore, the absolute premium increase on $100,000 of coverage would be less than the increase on $200,000 of coverage. The chosen deductible also affects the starting and ending premiums—higher deductibles provide lower premiums at any given level of coverage and risk (FEMA, 2016k).

The difference between a subsidized pre-FIRM premium rate and a full risk-based premium rate depends on the many factors that are taken into account when a full risk-based rate is determined. These include the presence of a basement and the difference between the first floor elevation and the base flood elevation (BFE). Rating tables are used that include these factors and incorporate potential damage risk based on hydrologic models. Various adjustment factors are also applied, such as the amount of deductible and whether the structure is insured to full value. Higher rates are charged for "basic" coverage (e.g., up to $60,000 for single-family residence structures) because the likelihood of a claim under that amount is higher; lower rates are charged for additional coverage above the basic limit

[24] This effect on individual policyholders is real and important from the policyholder perspective. However, from a social cost perspective, phasing out subsidies is more accurately thought of as a transfer, or a reduction thereof, since the current pre-FIRM rates carry an implicit subsidy that effectively transfers both risk and costs to FEMA and taxpayers. Thus, what amounts to an increase in costs to subsidized policyholders, represents a direct cost savings to taxpayers. Impacts to the NFIP and taxpayers are addressed in a separate section below.

(National Research Council of the National Academies, 2015a). Based on these many factors, the difference between a subsidized pre-FIRM premium and a full risk-based premium may be small or may amount to thousands of dollars annually and can only be determined on a case-by-case basis.

It will take multiple years for subsidized rates to rise to full-risk rates. For the first component of this alternative, given annual premium increases of 25 percent and current differentials between subsidized and full-risk rates (affected by factors such as coverage amounts, flood zone, and building elevation relative to the BFE), and accounting for estimated inflation rates, complete phase-out of subsidies could take 12 years or more (GAO, 2014) (GAO, 2016). For the second component, based on its slower rate increase schedule and the many factors that affect the difference between current and full-risk rates, complete phase-out of subsidized rates could take 25 years or more (GAO, 2014) (GAO, 2016). A long phase-out period allows time for policyholders to adjust to increased rates. For instance, policyholders could take actions that would provide lower rates, such as floodproofing or elevating buildings. However, some policyholders would experience full-risk based rates sooner than 12 years. As discussed below, some would experience higher than full-risk rates at some point unless they submit an elevation certificate to determine the specific full-risk rate for their property.

Policyholders would have differing abilities to absorb the increasing rate or the final full-risk rates, depending upon household or business income, other property and non-property expenses each household or business budget must cover, and other factors. Section 100236 of BW-12 required FEMA to engage the National Academy of Sciences to study how increased premiums could affect those least able to pay.[25] In response to this requirement, the National Academies Press has published an analysis, known as the "affordability study," in two reports (see Appendix G and Appendix H) (National Research Council of the National Academies, 2015a) (National Research Council of the National Academies, 2015b). The GAO has also studied affordability of NFIP premiums, including an assessment of options for assistance with affordability (GAO, 2016).

Further, HFIAA requires FEMA to prepare an "affordability framework." Section 9 of HFIAA states that "the Administrator shall prepare a draft affordability framework that proposes to address, via programmatic and Regulatory Changes, the issues of affordability of flood insurance sold under the National Flood Insurance Program, including issues identified in the affordability study required under Section 100236 of the Biggert-Waters Flood Insurance Act of 2012." (HFIAA, P. Law No. 113-389, § 29 (2014))

The affordability study noted that FEMA has limited ability to estimate the costs of premium increases at a community, regional, or national level. For example, FEMA lacks certain data, such as the first floor elevation, necessary to calculate the full risk-based premium for every subsidized policy.[26] In addition,

[25] Specifically, Section 100236 of BW-12 stated that FEMA "…shall enter into a contract under which the National Academy of Sciences, in consultation with the Comptroller General of the United States, shall conduct and submit to the Administrator an economic analysis of the costs and benefits to the Federal government of a flood insurance program with full risk-based premiums, combined with means-tested Federal assistance to aid individuals who cannot afford coverage…"

[26] As a result, FEMA cannot automatically stop the rate increases on all policies once the full-risk rate is reached on each policy. Most policyholders must take action to avoid indefinite increases in premiums as discussed in the content within this sub-section.

FEMA does not have the socioeconomic data regarding policyholders (for instance, income, wealth, and property value) necessary to estimate how increased premiums will impact policyholders (National Research Council of the National Academies, 2015b), nor does FEMA have any lawful purpose for requesting such private information from its policyholders under the Paperwork Reduction Act. The affordability study also suggested a range of issues and metrics that FEMA could consider in developing the affordability framework.

FEMA is currently developing the affordability framework. This effort includes quantitative analysis with the U.S. Census Bureau to gather more information about NFIP policyholders and their demographics, including income and home values. This work will provide critical information to determine how many NFIP policyholders may experience hardships—based on different concepts for defining affordability—due to the costs of flood insurance. FEMA anticipates having the affordability framework data and analysis by the end of 2017.

Much of the attention on affordability of flood insurance in recent studies and in the popular press has been focused on cost increases to primary residences. Policyholders for these policies vary widely in their income and wealth status. A low income household generally has less ability to pay a given premium than a high-income household. Ability to pay also depends on household living expenses, property taxes, other insurance, the presence and amount of a mortgage payment, and other factors. Nonetheless, the potential effects of premium rate increases on low income households and communities require particular attention.

Commercial properties may be better able to absorb premium increases, in part because business incomes may be substantial, and because many businesses may be able to pass on the increased costs to their customers in the form of price increases. The ability of businesses to pass on premium increases as price increases depends on local market conditions. Retail and service businesses may not be able to do so if customers have the option of patronizing other businesses that do not face premium increases; this would include businesses located outside of the SFHA that are still near enough to be reasonably convenient for customers. In such cases, passing on premium increases in higher prices would put the affected business at a competitive disadvantage. For businesses that rent space—to other businesses or as rental housing—the ability to pass on a premium increase depends on the availability of comparable rental units in the market. If there are few such units, then landlords may be able to pass on the additional cost; if there are many comparable units, this ability would be reduced. (National Research Council of the National Academies, 2015b)

The 2015 affordability study noted that businesses might also address increased premium rates through flood mitigation actions to reduce premium rates. However:

> Many of these flood insurance policies are for buildings concentrated in urban areas and were constructed in ways that make flood mitigation through elevation impractical. In lieu of elevating structures to mitigate flood loss, abandonment of commercial or rental use of the current first floor might be a mitigation action (to reduce premiums). In theory, this would impose a cost in the form of forgone rental income that may not be justified by premium savings. (National Research Council of the National Academies, 2015b)

Congress recognized in HFIAA that certain types of organizations FEMA classifies as commercial may have special concerns with affordability. Section 29 of HFIAA requires FEMA to assess the impacts of premium rate increases on small businesses (less than 100 employees), non-profits, and houses of worship. FEMA must also assess impacts on "residences with a value equal to or less than 25 percent of the median home value of properties in the State in which the property is located" (HFIAA, P. Law No. 113-389, § 29 (2014)). As of the writing of this NPEIS, this assessment is underway.

Premium rate increases on non-primary residences are an additional case. A policyholder with two or more homes may have higher income and/or wealth than a policyholder with only a primary residence, and thus may have more ability to absorb a premium increase on the additional home. However, policyholders who have high wealth (e.g., property value), but a modest income, may find premium rate increases troubling. This could include policyholders of modest income with long second-home tenure in a coastal or other area where property values have risen considerably. However, this type of issue is clearly different from that of a low income household facing premium rate increases on a primary residence.

As noted above, FEMA currently does not collect the data needed to conduct rigorous analysis about the extent to which premium increases would create affordability issues for different types of policyholders. However, FEMA does have data about the prevalence and magnitude of the premium increases that are currently occurring based on legislative requirements. Therefore, the significance criteria for the phase-out of subsidies use the available data. The criteria and rationale for each of the two criteria are as follows:

- Increases premium rates for policies covering residential buildings in the SFHA by greater than or equal to 18 percent annually for 10 percent or more of all housing units in SFHAs. This means: If the alternative in question causes the number of residential policies in the SFHA for which premium rates are increased by greater than or equal to 18 percent annually to exceed 10 percent or more of total housing units in the SFHA (as defined by the U.S. Census Bureau), it is significant for the purpose of this environmental analysis.
- Increases premium rates for commercial policies by greater than or equal to 18 percent annually for 5 percent or more of the total of NFIP policies. This means: If the alternative in question causes the number of commercial policies for which premium rates are increased by greater than or equal to 18 percent annually to exceed 5 percent of total NFIP policies, it is significant for the purpose of this environmental analysis.

The following narrative and tables present the data necessary to evaluate the phase-out of subsidies against the criteria above. Additional contextual data is included. Definitions and nuances necessary to properly understand the available data, such as differences between the definitions of residential policies and housing units, are described.

As of December 31, 2015, FEMA estimates that the number of NFIP "policies in force" (PIFs; hereafter, "policies") in the United States totaled 5.1 million.[27] Of those, an estimated 3 million were located in the SFHA.[28]

With respect to pre-FIRM subsidized policies, FEMA estimates that there were 77,173 non-residential policies and 794,978 residential policies as of December 31, 2015. These numbers constitute all the policies affected by the first and second components of Alternative 2. As reference points, Table 4-13 shows how pre-FIRM subsidized policies relate to all policies within the SFHA and the entire nation. Pre-FIRM policies constitute less than 30 percent of all policies in the SFHA, and just over 17 percent of all policies in the United States.

Table 4-11: Pre-FIRM Subsidized Policies as a Percentage of All Policies, 2015

Policy Type	Number of pre FIRM Subsidized PIFs	Percentage of All PIFs in the SFHA (3.0 million)	Percentage of All PIFs in the U.S. (5.1 million)
Residential	794,978	26.5%	15.6%
Non-Residential	77,173	2.6%	1.5%
Total	872,151	29.1%	17.1%

PIFs: Policies in Force

For residential policies, analysis of the impacts of pre-FIRM subsidized residential premium increases requires comparing FEMA policy statistics to housing unit statistics. Specifically, the ratio defined by the first significance criterion uses FEMA policy statistics for the numerator, and the denominator uses different FEMA statistics that are based on the U.S. Census Bureau's definition of a housing unit. This is necessary to focus the analysis on the SFHA. The material below explains differences in these data and uses the available data to make the best possible calculation of the ratio.

The U.S. Census Bureau defines a housing unit as follows:

> "A housing unit is a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied, or, if vacant, is intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants live separately from any other persons in the building and which have direct access from the outside of the building or through a common hall." (U.S. Census Bureau, 2013a)

[27] FEMA differentiates between policies in force and contracts in force. An insured structure represents one contract in force. Housing units within insured multi-unit structures typically each count as a policy in force. For example, a 100-unit condominium complex would count as one contract but 100 policies. However, there are some exceptions regarding multi-unit structures that result in FEMA's policies in force undercounting the total number of housing units in insured structures.

[28] All figures for numbers of policies in this section are for a "snapshot" of active policies on December 31, 2015; they do not represent cumulative policies for 2015.

Under this definition, a single-family house counts as one housing unit, a duplex house counts as two housing units, and an apartment building with five apartments counts as five housing units.

FEMA's residential policy (PIF) statistics are broken down into three occupancy categories. Occupancy 1 policies cover single-family buildings and single-family residential units within other buildings (non-single family buildings; e.g., multi-unit residential buildings or single residential units within mixed-use buildings). Occupancy 2 policies cover residential buildings containing 2-4 residential spaces. Occupancy 3 policies cover residential buildings with residential space for five or more families. Appendix E contains precise definitions. Although the concepts of residential units and residential spaces in FEMA's occupancy category definitions are functionally equivalent to the U.S. Census Bureau's definition of a housing unit, FEMA does not have complete counts of the number of residential units or spaces covered by FEMA policies for all types of structures for the Occupancy 2 and 3 categories. Therefore, it is not possible to compare total housing units covered by FEMA policies (an unknown number) to the total number of housing units in the SFHA (or any other geographic area).

However, it is possible to make a good comparison by focusing on Occupancy 1 policies. As will be shown below, pre-FIRM subsidized Occupancy 1 policies in the SFHA probably represent the vast majority of pre-FIRM subsidized housing units in the SFHA.

For the denominator of the ratio defined by the first significance criterion, an unpublished background FEMA analysis conducted in 2014 for the *Floodplain Management Standards Losses Avoided Study* estimated that as of 2011, there were 7,098,613 single-family residential buildings in the SFHA. A single-family residential building as defined by that FEMA analysis counts as a single housing unit according to the U.S. Census Bureau definition of a housing unit, and if covered by a NFIP policy, counts as an Occupancy 1 policy (FEMA, 2014).

Table 4-12 provides the data necessary to identify the numerator for the ratio defined by the first significance criterion. The table provides a breakdown of pre-FIRM subsidized residential policies by the category of legislatively required premium rate increase and by FEMA occupancy category. The right-most column of this table shows that as of December 31, 2015, nearly 70 percent of the pre-FIRM subsidized residential policies (553,287 policies accounting for 69.6 percent of all pre-FIRM subsidized residential policies) are subject to the second component of Alternative 2 (5 to 15 percent annual increase in premium rate per risk classification, with no individual policy exceeding an 18 percent premium rate increase), affecting mainly pre-FIRM subsidized primary residence policies. Just over 30 percent of pre-FIRM subsidized residential policies are subject to the first component of this Alternative (25 percent annual increase in premium rate).

Table 4-11 provides further detail on these pre-FIRM subsidized residential policies, showing the 2015 premium, the percentage premium rate increase applied by FEMA in 2016, and the corresponding dollar increase in premium, by rate category and FEMA occupancy category, as well as the percentage of all pre-FIRM subsidized residential policies in each rate/occupancy category. Four of the six categories account for 98.6 percent of all the pre-FIRM subsidized residential policies. Three of these four categories are subject to the 5 to 15 percent premium rate increase for pre-FIRM subsidized primary residence policies, and received the minimum 5 percent rate increase for 2016. Key information for these three categories is as follows:

- Occupancy 1 (Single-Family Dwelling) Subject to 5 – 15 percent Annual Increase: 43.4 percent of all pre-FIRM subsidized residential policies; average 2015 premium of $1,422; average 2016 premium increase of $71.
- Occupancy 2 (2-4 Unit Building) Subject to 5 – 15 percent Annual Increase: 6.8 percent of all pre-FIRM subsidized residential policies; average 2015 premium of $1,405; average 2016 premium increase of $70.
- Occupancy 3 (5+ Unit Building) Subject to 5 – 15 percent Annual Increase: 19.4 percent of all pre-FIRM subsidized residential policies; average 2015 premium of $774; average 2016 premium increase of $39.

The fourth category that constitutes a large percentage of all the pre-FIRM subsidized residential policies in Table 4-12 and Table 4-13 is the category for Occupancy 1 (Single-Family Dwelling) that is subject to the mandated 25 percent annual premium rate increase for pre-FIRM subsidized non-primary residences, business properties,[29] severe repetitive loss properties, substantially damaged or improved properties, and properties for which the cumulative claims payments exceed the fair market value of the property. There were 230,694 policies in this category. These policies made up 29 percent of all pre-FIRM subsidized residential policies, had an average 2015 premium of $1,811, and had an average 2016 premium increase of $453. This is a large increase, more than six times that of the increase for pre-FIRM subsidized primary residences that are single-family dwellings. For these policies, the magnitude threshold of the first significance criterion applicable to phase-out of pre-FIRM subsidized policies would be met.

Nevertheless, based on the ratio defined by the first significance criterion, there would not be a sufficient number of impacted policies to meet the prevalence threshold. The definition of Occupancy 1 (Single-Family Dwelling) is largely consistent with the definition behind the figure from the background FEMA analysis conducted in 2014 for *Floodplain Management Standards Losses Avoided Study* of 7,098,613 single-family residential buildings in the SFHA (FEMA, 2014). It is not entirely consistent because Occupancy 1 includes some single-family residential units within other buildings; i.e., non-single-family buildings. As shown below, this difference does not make a decisive difference to the analysis result.

Therefore, the first criterion can be evaluated as the ratio of 230,694 pre-FIRM subsidized single-family residential policies subject to annual premium rate increases greater than or equal to 18 percent (the numerator), divided into 7,098,613 single-family residential buildings in the SFHA (the denominator).[30] This ratio is 3.2 percent, which is less than the prevalence threshold of 10 percent for this criterion.

There are two caveats to consider regarding the result:

1. The definition of and number of Occupancy 1 policies (numerator) includes single-family residential units within non-single family (i.e., multi-unit) buildings, while the figure for single-family residential buildings in the SFHA (denominator) does not. An adjustment, if the necessary data were

[29] Not included in these tables.

[30] FEMA acknowledges that the year (2015) of the first data point (230,694) differs from the year (2011) of the second data point (7,098,613). FEMA used the best available data for each term of the ratio. Note that if the 2011 datum in the denominator of the ratio were updated to 2015, the denominator almost certainly would be larger (more single-family residential buildings in the SFHA) and the resulting ratio (percentage) would be smaller. In short, the different numerical result would not change the conclusion.

available, would either modify the Occupancy 1 data by removing policies for single-family residential units within non-single family (i.e., multi-unit) buildings from the numerator, or add the corresponding number of housing units in non-single family buildings to the denominator. In either case, the ratio would be smaller.

2. Some pre-FIRM subsidized residential policies (specifically those policies falling under the Occupancy 2 and 3 categories) are not included in the calculation of the ratio. Table 4-12 shows that the number of policies in these categories that are subject to a 25 percent annual increase in premium rate is low (2,302 policies for 2-4 unit buildings, and 8,695 policies for 5+ unit buildings). If the data were available, to properly account for the housing units represented by these policies, that number of housing units would have to be added to both the numerator and denominator. Even if the number of units in these categories were considerably greater[31] than the number of policies, the prevalence threshold of 10 percent would not be met.

Based on the analysis above, the 10 percent prevalence threshold of the first criterion would not be met. Therefore, while FEMA acknowledges that the premium rate increases may be difficult for some residential policyholders subject to the 25 percent annual increase, the impact is considered less than significant.

The second criterion, addressing commercial (non-residential) policies, is addressed next. Table 4-11 above shows that as of 2015 there were 77,173 pre-FIRM subsidized policies covering commercial buildings. For 2016, these policies were subject to a 25 percent annual premium rate increase, which is greater than the 18 percent magnitude threshold under the second significance criterion. The average premium for approximately 89 percent of these policies in 2015 was $2,987, and for 11 percent the average premium was $3,120. Thus, the average premium increases for 2016 were, respectively, $747 and $780. As discussed earlier, the criterion for commercial policies compares the number of such policies subject to annual premium rate increases greater than or equal to 18 percent (effectively 77,173 policies) to the total number of NFIP policies (5.1 million). This ratio is 1.5 percent, which is less than the 5 percent prevalence threshold of the criterion. Thus, the second significance criterion is not met. Therefore, while FEMA acknowledges that the premium rate increases may be difficult for some commercial policyholders, the impact is considered less than significant.

In summary, FEMA acknowledges that premium rate increases will generate financial impacts that may be difficult for some policyholders and some communities. The affordability framework analyses that are now underway will provide further information and will assist FEMA in understanding how to reduce those impacts. The impacts will not be difficult for many other policyholders and communities. Based

[31] The total number of units added to the numerator and denominator would have to be slightly over 532,000 for the 10 percent prevalence threshold to be exceeded. Assuming the 2,302 policies for 2-4 unit buildings all have 4 units (highly unlikely), they would total 9,208 units. The remaining 522,792 units (532,000 minus 9,208) would be spread across the 8,695 policies for 5+ unit buildings, which would mean the average building would have 60 units. This is highly unlikely. It is relatively rare for housing units to be located in buildings with large numbers of units. Nationally in 2013, the number of housing units in buildings with 50 or more units constituted only 3.9 percent of all units, and the number of units in buildings with 50 or more units constituted only 23.1 percent of all units in buildings with 5 or more units. (U.S. Census Bureau, 2015).

on the significance criteria, in the larger picture of the entire SFHA and the NFIP, the impacts of the premium rate increases that phase-out subsidies would be less than significant.

Table 4-12: Pre-FIRM Subsidized 2015 Residential Policies and Average Premiums by Category and Occupancy Type

	Occupancy 1 (Single-Family Dwelling)			Occupancy 2 (2-4 Unit Building)			Occupancy 3 (5+ Unit Building)			All Occupancies	
Pre FIRM Subsidized Premium Rate Increase Category	Pre-FIRM Subsidized Residential PIF Count	Percent of All Pre-FIRM Subsidized Residential PIFs	Average Premium	Pre-FIRM Subsidized Residential PIF Count	Percent of All Pre-FIRM Subsidized Residential PIFs	Average Premium*	Pre-FIRM Subsidized Residential PIF Count	Percent of All Pre-FIRM Subsidized Residential PIFs	Average Premium*	Pre-FIRM Subsidized Residential PIF Count	Percent of All Pre-FIRM Subsidized Residential PIFs
Subject to 25% Annual Increase	230,694	29.0%	$1,811	2,302	0.3%	$1,452	8,695	1.1%	$830	241,691	30.4%
Subject to 5 – 15% Annual Increase	345,046	43.4%	$1,422	53,820	6.8%	$1,405	154,421	19.4%	$774	553,287	69.6%
PIF Totals	575,740	72.4%	NA	56,122	7.1%	NA	163,116	20.5%	NA	794,978	100.0%

PIF: Policy in Force
NA: Not Available
*Includes Federal Policy Fee

Table 4-13: Pre-FIRM Subsidized 2015 Average Residential Premiums and 2016 Average Premium Increases

	Occupancy 1 (Single-Family Dwelling)				Occupancy 2 (2-4 Unit Buidling)				Occupancy 3 (5+ Unit Building)			
Pre FIRM Subsidized Premium Rate Increase Category	Percent of All Pre-FIRM Subsidized Residential PIFs	2015 Average Pre-FIRM Subsidized Premium	2016 Percent Increase in Pre-FIRM Subsidized Premium	2016 Dollar Increase in Pre-FIRM Subsidized Premium	Percent of All Pre-FIRM Subsidized Residential PIFs	2015 Average Pre-FIRM Subsidized Premium*	2016 Percent Increase in Pre-FIRM Subsidized Premium	2016 Dollar Increase in Pre-FIRM Subsidized Premium**	Percent of All Pre-FIRM Subsidized Residential PIFs	2015 Average Pre-FIRM Subsidized Premium*	2016 Percent Increase in Pre-FIRM Subsidized Premium	2016 Dollar Increase in Pre-FIRM Subsidized Premium**
	29.0%	$1,811	25.0%	$453	0.3%	$1,452	25.0%	$363	1.1%	$830	25.0%	$208
Subject to 5 – 15% Annual Increase	43.4%	$1,422	5.0%	$71	6.8%	$1,405	5.0%	$70	19.4%	$774	5.0%	$39
PIF Totals	72.4%	NA	NA	NA	7.1%	NA	NA	NA	20.5%	NA	NA	NA

PIF: Policy in Force
NA: Not Available
*Includes Federal Policy Fee
**Overestimates actual increase due to inclusion of Federal Policy Fee of $45 - $1,800 per policy

FEMA also notes that under the No Action Alternative, the level of premium increases occurring prior to BW-12 (6.82 percent on average for 2008-2012) would continue. Therefore, a substantial portion of the premium increases under Alternative 2 would occur under any alternative. Also, for many policyholders the premium rate increases would occur in the context of discounts received because their community participates in the CRS. These discounts would reduce the dollar amount of the increase in premium relative to the increases for policyholders who do not receive CRS discounts. Currently, 1,391 communities participate in the CRS. While this represents only 5 percent of the over 22,000 communities participating in the NFIP, more than 69 percent of all flood insurance policies are written in CRS communities (FEMA, 2016b) (FEMA, 2016a).

Effects of Elevation Certificate Costs

As subsidies are phased out over time, FEMA would automatically switch policies with elevation certificates to full-risk rates when the full-risk rate becomes cheaper than the pre-FIRM subsidized alternative (FEMA, 2016c). However, for the vast majority (over 89 percent) of pre-FIRM subsidized policies, FEMA lacks the building-specific elevation data needed to determine the appropriate full-risk rate. FEMA cannot automatically switch these policies to full-risk rates. This creates the potential for premiums to "balloon" to very high levels. For instance, FEMA has projected that the average single-family primary residential policy pre-FIRM subsidized rate in 2017 would be $1,889. In the absence of other action, this would increase to $3,533 in 2026. (This assumes the following distribution of rate increases within the 5 to 15 percent range established by statute: 5 percent for the first four years, 7.5 percent for the following four years, and then 10 percent per annum thereafter) (see Appendix F) (FEMA, 2016i). An average single-family non-primary residential policy, which is subject to a statutory 25 percent increase per year, would increase from $3,296 in 2017 to $24,560 by 2026. Given that indefinite annual premium rate increases would result in premiums that exceed full-risk rates, FEMA assumes that policyholders would at some point seek refuge from the naturally occurring rate increases that further inflate their NFIP premiums through the proactive procurement of an elevation certificate that would establish their actual flood risk (see Appendix F) (FEMA, 2016i).

An elevation certificate must be completed by a qualified private sector professional (e.g., a surveyor). The cost varies substantially from region to region and location to location, depending on the availability of survey benchmarks; the nature of local terrain, vegetation, and development; going market rates; and other factors. Costs range from a common rate of $150 in Louisiana and Florida in the more urban areas with lots of benchmarks and competition, to thousands of dollars in Alaska. A somewhat recent FEMA estimate arrived at the amount of $350 per elevation certificate on average. This is a one-time cost (see Appendix F). (FEMA, 2016i)

This $350 cost, and variations above and below it, may be inconsequential to some policyholders and consequential for others, depending on their financial situations. However, all policyholders opting to switch out of the indefinite increase schedule, who would absorb the costs of obtaining an elevation certificate to do so, would be saving themselves the impending scheduled premium increase for that year and each year thereafter. Within one or several years, those savings would more than offset the cost of obtaining the certificate.[32] Note that all holders of policies subject to the 25 percent per year premium rate increase would be expected to switch from subsidized rates to actuarial full-risk rates far more aggressively than primary residence policyholders (see Appendix F) (FEMA, 2016i). Because of the net savings over time from the costs of obtaining an elevation certificate, the impact on policyholders would be considered beneficial, and less than significant.

4.3.1.3.1.2 Reductions in Property Value and Tax Revenues

Potential reductions in property values are another potential effect of increased flood insurance premiums. This effect could occur because, in a properly functioning real estate market, operation and maintenance costs associated with property are capitalized into the value of the property. A property with high costs has lower value than a property with lower costs, all other factors being equal. This can be explained as follows:

> One way to illustrate the effect is to use a simple capitalization calculation as might be done by a property assessor. For example, a $1,000 per year increase in premiums from losing a pre-FIRM subsidized rate could result in a $20,000 reduction in property value (5 percent discount rate); a $2,000 increase might be $40,000. The loss in property value could be a small or large part of total asset value and could be a small or large part of the property owner's total wealth, recognizing that the property owner may have other assets. (National Research Council of the National Academies, 2015b)

It is important to note that the property value effect may show up in the market value of a property once the premium increase is known, but the cash loss is not actually incurred until the property is sold. In this respect, the property value effect is a different manifestation of the increased cost of ownership effect described above (see the section on direct cost effects on policyholders), rather than an additional effect. In other words, "the economic impact on the seller is essentially the same as the impact of the future higher insurance premiums if the property had not been sold. The former is merely the capitalized value of the latter" (National Research Council of the National Academies, 2015a). However, other effects of property value reductions would occur more immediately (prior to a property sale). The ability of a property owner to borrow against the equity in the property may be reduced.

A different but related effect is the potential impact on a property owner's ability to sell a property. The increased "carry cost" of a higher premium and any uncertainty over what that cost will be could reduce the number of potential buyers, create uncertainty over the proper price (National Research Council of the National Academies, 2015b), generate buyer reluctance to commit to a purchase decision, and affect the amount of time a property is on the market.

[32] As a documentation requirement and a tool to establish risk and attain a full-risk rate, each elevation certificate would need to be processed to translate into these intended effects. Each certificate would need to be recorded, and its contained information applied to rate maps, zones and rate structures. This, however, is not received, executed or individually approved by the policyholders, the NFIP or FEMA, but by the WYO companies that interface directly with policyholders. These expenses borne by the WYO companies servicing the NFIP would be directly factored in to their compensation and therefore reimbursed by the program as an operating expense.

Reduced property values also have implications for local government finance. An affected property owner may receive a lower assessed value and thereby pay lower property taxes. However, this also means a reduced tax base and reduced revenues for the local taxing authorities.

This discussion is relevant to two of the significance criteria: Economic Characteristics (Employment or Tax Revenues) (specifically, tax revenues), and Housing Characteristics (in particular, housing values). As demonstrated here, impacts would be expected under both criteria. However, the impacts would not be considered substantial. First, this is because the direct cost effects on policyholders, which are the precursor to impacts on housing values and tax revenues, are themselves not significant based on the significance criteria and analysis in Section 4.3.1.3.1.1, Direct Cost Effects on Policyholders. Second, as discussed for the No Action Alternative (Section 4.3.1.2.2, Impacts on Economic Characteristics (Employment or Tax Revenues)), capitalized flood insurance premiums are small relative to total property values, and impacts on tax revenues are commensurately small. Therefore, the impacts of the legislatively required phase-out of subsidies on tax revenues and housing values are considered less than significant.

4.3.1.3.1.3 Impacts on Lessees of Policyholders

To the extent property owners pass on increased flood insurance premiums to renters as increased rents, the lessees face increased costs. This would affect the bottom line of lessee businesses, or the household budgets of residential lessees. The impact of such cost increases on lessees depends on similar factors as those described above for property owners: the amount of the increase, how quickly the increase occurs, and income and expense factors that affect lessees' ability to absorb the increase.

While some impacts on lessees are possible, these impacts would affect an even smaller subgroup of policies than those considered above in terms of direct cost effects on policyholders. Those effects were found to be less than significant. By extension, impacts on lessees of policyholders would be less than significant. In addition, at least some lessees would have the ability to move to avoid passed-on costs.

Lessees can obtain coverage for their personal property contents (a contents-only policy) independently of their lessor, whether the lessor has an NFIP policy or not. Pre-FIRM subsidized contents-only policies were included in the policy statistics, impact analysis, and finding of a less than significant impact in Section 4.3.1.3.1.1, Direct Cost Effects on Policyholders.

4.3.1.3.1.4 Impacts on Community Vitality and Resilience

If increased premiums result in reduced property values among a large enough portion of the property base of an area, the overall desirability and property value of the neighborhood or community could be affected. This probably would only occur in a relatively small proportion of communities participating in the NFIP—those with areas that have high ratios of subsidized properties to total properties.

As noted above, to the extent reduced property values occur in a participating community, tax revenues from those properties would decline. This could have a noticeable impact on the budgets of communities where large numbers of subsidized properties exist. In such cases, community services and investments could be affected.

Actions taken by policyholders or lessees to avoid premium rate increases—such as elevating structures, moving, or vacating first floor space—could impact the character of neighborhoods and communities. The effects could be aesthetic—regarding the visual look of physical changes—and could be broader. For instance, with respect to vacating first floor space, the affordability study previously commissioned by FEMA notes that, "even if justified by premium savings, vacating retail space (if that was the use) may diminish the mix and pattern of retail and residential space that defines 'neighborhood character'" (National Research Council of the National Academies, 2015b).

There has been discussion in the popular press, and some in the academic literature, that increased flood insurance premiums could ultimately manifest in major changes to community character, such as "increased number of rental properties, reduced commercial activity, increased blight, and increased out-migration" (Nance, 2015). These discussions have been speculative. Most occurred in the context of BW-12, particularly due to BW-12's elimination of grandfathering of policies. However, HFIAA reinstated grandfathering, and thus has probably reduced the potential (if any ever existed) for such dramatic effects.

Some policyholders may choose to avoid premium rate increases by dropping their policy or reducing their coverage. However, there is a mandatory flood insurance purchase requirement for federally backed mortgages, and lenders may have their own requirements for coverage. Property owners who drop flood insurance coverage would be more vulnerable to significant economic losses should a flood occur. Further, to the extent many property owners in a community make similar decisions, the economic and social resilience of a community—its ability to recover effectively from a disaster—would be affected (National Research Council of the National Academies, 2015a).

Impacts on community vitality and resilience could contribute to impacts on Economic Characteristics (Employment or Tax Revenues), and impacts on Housing Characteristics. At the present time, FEMA lacks the data necessary to determine the extent to which premium rate changes would affect neighborhood/community desirability and property values. Similarly, the distribution and magnitude of impacts on tax revenues cannot be readily determined. Impacts on neighborhood character and community resiliency are even less amenable to quantification. However, to the extent such impacts exist, they would occur gradually over an extended time due to the long time period in which the phase-out of subsidies would occur. This would give communities time to recognize and respond to any such changes. Further, due to the mandatory flood insurance purchase requirement for federally backed mortgages, FEMA believes that the number of communities that see widespread rates of NFIP policyholders dropping their coverage should be very limited. Therefore, most communities would still experience the resiliency benefit provided by flood insurance when funds return to the community to cover damage claims. Given these factors, this type of impact is considered less than significant.

4.3.1.3.1.5 Indirect Economic Impacts on Income and Jobs

Increased costs constitute direct impacts on affected policyholders and their lessees. Because these direct costs result in reallocation of business and household budgets, they affect spending in the local and regional economies. For example, if a business must pay $2,000 more in annual flood insurance premiums, approximately 27 percent of the $2,000 in increased premium would accrue to the NFIP WYO carrier, as compensation for services rendered (FEMA, 2011). This compensation covers all direct expenses in servicing policies, overhead, and other expenses. WYO carriers must be located in the State of the serviced policy. Agents and back office functions may be located in the community of the serviced policy, or in another region of the State. Thus, some of the increased compensation to WYO carriers may result in increased spending and wage payments by the carrier in the local economy, while in other cases those changes may occur in other parts of the State.

About 44 percent of flood insurance premiums is used to pay for current losses and approximately 17 percent is used to pay interest or current debt or to build a cash reserve to pay future claims (FEMA, 2011), thereby leaving the local economy until an unknown future date when losses occur and claims are paid. This removal of funds from the local economy for an indefinite period has "indirect" and "induced" impacts on the local economy. "Indirect impacts" are changes in income, employment, and economic output resulting from changes in purchases occurring between businesses. For example, the subject business might have spent some of the $2,000 on purchasing supplies from other local businesses. The change represents an income loss to those other businesses, and they in turn may reduce purchases from their suppliers. Businesses also use some of their income to pay employees, thereby supporting employees' households. "Induced impacts" are the impacts resulting from changes in household spending; for instance, purchases at local retail stores or visits to the dentist. Reductions in employee wages result in lower spending by households at other businesses. If the indirect and induced impacts are large enough, jobs may be affected—businesses may have to reduce the number of their employees. Tax revenues may also be affected; for instance, sales tax revenues as they are based on levels of economic activity in a community or State. These changes ripple through an economy; the aggregate changes relative to the initial direct impact are known as the "multiplier effect" (Miller & Blair, 2009).

Based on the economic logic described above, phasing out subsidies by increasing premium rates would have some impact on income and jobs in the local and regional economies. On a net basis these changes would be negative (reduced economy activity) because the large portion of the premium rate increases that accrue to the NFIP would be removed from business and household expenditure cycles. However, these impacts would be moderated to some extent because it would take multiple years for subsidized rates to rise to full-risk rates—in some cases up to 25 years or more according to recent estimates (GAO, 2014). A long phase-out period gives time for an economy to adjust to and absorb the changes in economic activity.

This discussion is relevant to the significance criterion Economic Characteristics (Employment or Tax Revenues). Based on the economic logic described above, it is likely that Alternative 2 would have some impacts on income, employment, and possibly tax revenues. FEMA is not aware of any large-scale, rigorous studies of the indirect economic impacts associated with premium rate increases. In a localized study, Cotton and Murasko suggest large indirect economic impacts, along with property value and tax revenue reductions, could occur in the portion of the Houston, Texas region they examined (Cotten & Murasko, 2013). However, their report is not completely transparent in describing their methodologies and assumptions. For instance, they do not specify which economic impact model they apply to generate the impact estimates.

As discussed for the No Action Alternative, impacts on economic characteristics due to reduced economic activity or property values, even when considering all premiums (let alone the small subset of policies affected by Alternative 2), are small relative to total economic activity and total property value / tax base. For this reason, and due to the long subsidy phase-out time that would give local economies time to adapt, this type of impact is considered less than significant.

4.3.1.3.1.6 Effects on the NFIP and Federal Taxpayers

Phasing out subsidies as proposed would have additional effects besides those on policyholders and communities. These include effects on the NFIP itself and on Federal taxpayers.

As noted in the description of impacts of the No Action Alternative, subsidized rates affect the financial soundness of the NFIP, and taxpayers essentially make up any shortfalls when the program borrows from the Federal Treasury (GAO, 2014) (Congressional Research Service, 2013). Thus, to the extent phasing out subsidies provides greater revenue to the NFIP, the financial sustainability of the NFIP would improve, and the potential impacts on Federal taxpayers would decrease. One caveat on this result is that higher rates due to loss of subsidies could result in some policyholders dropping their coverage, which would reduce the NFIP's revenues. This may also result in additional exposure of Federal taxpayers to uncovered flood losses (e.g., via Federal disaster assistance and casualty loss deductions under Federal income taxes).

Even in cases where purchase of flood insurance is mandatory due to a property in a SFHA having a federally backed mortgage, there is evidence that some such property owners do not purchase flood insurance. For instance, a 2013 Congressional Research Service report suggested that only 18 percent of Americans in flood zone areas have flood insurance (Congressional Research Service, 2013). There is also concern that compliance rates may be further reduced, particularly for households with limited ability to pay (National Research Council of the National Academies, 2015b). In addition, those not required to purchase flood insurance would be free to drop coverage if they do not perceive a value in being covered at an increased premium cost.[33] These decisions all reflect what economists call the price elasticity of demand, which refers to how the rate of purchases changes with changes in price. For flood insurance, the literature on price elasticity is mixed, although some FEMA data indicates that when prices of insurance increase, purchases of insurance decline. The evidence is not conclusive enough to allow prediction of the impacts of premium rates increases on total revenues from flood insurance purchases.

In addition to the net positive impact of premium rate changes on the NFIP's financial footing, phasing out subsidies would affect that footing through another mechanism. One strategy that policyholders may use to reduce their premiums as subsidies are phased out is to move their building(s) or take other actions, such as elevating structures in-place, to reduce flood risk and thereby obtain lower premiums. While such

[33] Dropping flood insurance coverage, or choosing never to take coverage, has significant implications to property owners, communities and Federal taxpayers in the event of a flood. Property owners are exposed to uninsured losses that are only partly compensated by Federal flood disaster relief (AIR - Sarmiento and Miller, 2006). Uncovered losses can be financially devastating. Uncovered losses may exacerbate impacts on local governments, which include disruption of local government expenditures and intergovernmental revenues, and increases in local government debt (AIR - Sarmiento and Miller, 2006). Finally, low flood insurance participation rates increase the burden on Federal taxpayers, who fund Federal disaster relief (Congressional Research Service, 2013).

actions would be costly to the individual policyholder (and may or may not provide a financial return relative to the long-term reduction in premium payments), the net effect to the NFIP would be reduced potential for flood losses and claims payouts. This would also reduce the exposure of taxpayers to flood losses not covered by NFIP premiums.

4.3.1.3.1.7 Regional and Local Variations

Certain States and communities would be more affected by phasing out subsidies than others, due to differences in numbers of pre-FIRM policies. The first report of the affordability study (National Research Council of the National Academies, 2015a) included an assessment of the geographic distribution of pre-FIRM policies. The study found that, in general, the States with the most NFIP policies in force as of October 2013 also have the most pre-FIRM policies. The seven States with the most pre-FIRM policies are California, Texas, New York, Florida, Louisiana, New Jersey, and Pennsylvania. Another perspective to consider is the ratio of pre-FIRM policies to all policies. The Midwest and Great Lakes areas have the highest ratios. Specifically, most of the States of FEMA Region V (Wisconsin, Illinois, Indiana, Michigan, and Ohio, but not Minnesota) are in the highest ratio class: 45 to 59 percent of all policies in those States are pre-FIRM policies. Region IV has one State in this class (Kentucky), Region III has two States (West Virginia and Pennsylvania), Region II has Puerto Rico, and Region I have two States (Vermont and Connecticut). There are 10 States in the next ratio class (35 to 44 percent): Nebraska, Kansas, Oklahoma, Iowa, Missouri, Arkansas, New Jersey, Rhode Island, Massachusetts, and New Hampshire. It is thought that southern and western States have lower ratios of pre-FIRM to all policies because population growth in those States means that many housing units were built after local FIRMs were established, and thus higher proportions of policies pay full-risk rates (National Research Council of the National Academies, 2015a).

High numbers of pre-FIRM policies or high ratios of pre-FIRM to all policies at the State level do not themselves indicate a likelihood of significant effects on communities. More localized data indicating community-level concentration is required, plus additional analysis to determination the actual financial and economic magnitude of the changes, and socioeconomic data to determine whether hardships would be created. With respect to community-level concentration, data used in the affordability study showed that 80 percent of all NFIP policies are located within just 6 percent of the nation's census block groups. (A census block group contains about 600 housing units, on average.) Spatial analysis showed that States with large numbers of block groups that have concentrations of pre-FIRM policies include all the States noted in the summary above, but include other States as well, and all States have at least some such block groups. (National Research Council of the National Academies, 2015a) With respect to the financial and economic magnitude of increased premiums in communities with concentrations of pre-FIRM policies, FEMA lacks the data to calculate net premium rate increases on a community-by-community basis. Further, FEMA lacks the data needed to determine the distribution of those increases across households and communities of different socioeconomic status. FEMA's current work on the affordability framework, including collaboration with the U.S. Census Bureau regarding socioeconomic data, will improve FEMA's ability to assess geographic variations in the effects of phasing out subsidies on pre-FIRM policies. FEMA expects to complete this work by the end of 2017.

4.3.1.3.2 Legislatively Required Change: Development of a Monthly Installment Plan Payment Option

The third component of this alternative would involve the implementation of a monthly installment plan payment option, limited by statute to policies that have non-escrowed flood insurance premiums. Lenders are required to escrow all premiums and fees for flood insurance for loans secured by residential real estate or mobile homes in a SFHA that are made, increased, extended, or renewed on or after January 1, 2016, subject to certain exceptions, including an exception for small lenders. This includes policyholders who have been required to purchase flood insurance because they have mortgages from federally backed or regulated lenders and their properties are located in the SFHA. Currently there are approximately 3 million policies in force within the SFHA and 2.1 million outside the SFHA.

For policies that do not have escrowed NFIP premiums (i.e., policies on properties without a mortgage), FEMA would provide a monthly installment payment option. This would help those policyholders manage costs by spreading out their premium payment throughout a year instead of having to pay the entire premium one time per year. FEMA does not at this time know how many policies would be eligible for this provision. As a reference point, across all owner-occupied homes nationwide, 34 percent do not have a mortgage and therefore do not have escrowing (U.S. Census Bureau, 2016b). However, it is unknown what percentage of these non-escrowed homes are covered by NFIP policies.

This component of Alternative 2 is potentially relevant to the significance criterion for Economic Characteristics (Costs of Flood Insurance). While it is not directly related to the phase-out of subsidies and would not affect the amount of the cost increases under the first two components of Alternative 2, this component could benefit affected policyholders (any policyholder, pre-FRIM subsidized or not, with non-escrowed premiums) by giving them a payment option that could reduce cash flow issues for household or business budgets due to large annual flood insurance payments. This may be helpful to policyholders experiencing large premium rate increases due to the phase-out of pre-FIRM subsidies.

Additionally, while participating policyholders will pay the same premium each year, they will effectively pay less in economic terms by spreading their premium payments through the year. This benefit is due to the "time value of money," which means that, all other things being equal, a rational person would rather have a dollar now than a dollar in the future. Put another way, a dollar in the future is worth less than a dollar now, so future payments effectively cost less than equivalent current payments. The difference between future value and present value is known as the discount rate. The Office of Management and Budget recommends application of a discount rate of 7 percent for regulatory analysis (Office of Management and Budget, 2003). This discount rate means, effectively, that $1.07 now is worth $1.00 a year from now. The discount rate applies to monthly payments as well, with each payment discounted by a larger and larger portion of the 7 percent annual discount rate. As an illustration, the national average flood insurance annual premium of $864, when paid via a series of 10 equal payments, only costs the policyholder $837 dollars when a 7 percent discount rate is taken into account, a savings of $27 in economic value (FEMA, 2016i).

However, these benefits will be offset by FEMA's intended addition of a monthly service fee. While FEMA has not worked out all the details of how this installment plan payment option would be implemented, its use would require the policyholder to pay an installment plan service fee, which is consistent with standard industry practice. The fee would be based largely or entirely on compensating insurance companies for the costs of administering the installment plan option. These costs include:

- Administrative costs of mailing and handling monthly payments, including the increased administrative costs of processing/handling payment delinquency on a monthly basis (instead of just one time annually when the policy is purchased or renewed). (FEMA, 2016i).
- The cost of changing computer systems to handle monthly payments (e.g., software, etc.) (FEMA, 2016i). FEMA estimates that this cost would be approximately $2.5M for each of six vendors that service the WYO insurance companies.[34]

The monthly service fee, summed across the year, would almost certainly be larger than the economic savings from the time value of money mentioned above. For instance, a fee of $5-10 per month, or $60-$120 annually, is much larger than the $27 in economic savings for the average premium mentioned above. Therefore, eligible policyholders, if they choose to participate in this program, would do so because they deem the extra cost worthwhile in helping alleviate any cash flow issues associated with paying on an annual basis. Thus, FEMA considers the impact on Economic Characteristics (Costs of Flood Insurance) for those who make this choice to be beneficial; however, the effect would be less than significant as the cash flow benefit would not reduce (and would likely somewhat increase) the total cost of flood insurance for participating policyholders.

There could also be a marginal (less than significant) beneficial effect on the NFIP and Federal taxpayers. One benefit of the installment plan option could be higher rates of policyholder retention due to the availability of the installment plan option, which could in turn help maintain income to the NFIP from premium payments and result in fewer uninsured properties whose flood losses may instead be covered by Federal taxpayers (e.g., Federal disaster assistance and casualty loss deductions under Federal income taxes). See Section 4.3.1.3.1.6 for a related discussion.

It is not known whether there would be any regional differences in use of a monthly installment plan option. It is likely that some communities have greater rates of non-escrowed premiums than others, and therefore probably would see greater use of the option.

This component of Alternative 2 would have negligible or no impact on other aspects of socioeconomic resources. Because impacts of this alternative on the costs of flood insurance are small, it would not alter employment or tax revenues. Alternative 2 has no relationship to and therefore would not change housing characteristics or development patterns, alter population growth or demographic patterns, alter ecosystem services, or compromise public health or safety services. Additionally, Alternative 2 would not cause disproportionately high and adverse human health or environmental effects on environmental justice populations and may even have a minor beneficial effect on members of environmental justice populations (as well as the general public) who choose to participate.

[34] Although there are 80 WYO companies, there are 6 vendors that support those companies and perform services and functions related to the NFIP on their behalf, such as servicing the policies, policy issuance, policy administration, policy endorsements, policy reformations, policy cancellations and non-renewals, policy correspondence, claims processing, claims adjusting, etc.

4.3.1.3.3 Floodplain Management Criteria Guidance

This component of Alternative 2 would clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain. Under 44 C.F.R. § 60.3(a)(2), a community is currently required to review proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law. This includes compliance with the ESA. Assuming project proponents are in compliance with existing laws, a key change from current requirements is to require communities to maintain documentation of compliance. Communities (local governments) would incur costs to maintain this documentation.

The impact of documentation costs on local government depends on several factors. First, it depends on the number of development proposals. FEMA estimates that, on average, the approximately 22,200 (as of November 2016) communities in the NFIP process just under 4 proposals for development in the SFHA per year per community (FEMA, 2016a). Obviously, some communities handle more proposals and some handle less. Second, undoubtedly some communities already retain such documentation, but the retention rate among communities is not known. Third, those communities that do not already retain documentation would incur some costs to do so. This would include costs of reviewing, processing, filing, and maintaining documentation. This increased burden is probably small; FEMA anticipates that, in most cases, communities would simply check to ensure there is sufficient documentation and place a copy of that information into an existing file (Appendix I) (FEMA, 2016h).

Based on the small average number of development proposals per community, the likelihood that some portion of the communities already maintain documentation, and the low resource requirement per proposal to maintain documentation, it is highly unlikely that this component of Alternative 2 would meet the threshold of the public or private resources significance criterion of Section 4.3.1.1. That criterion is: "Requires an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions or the viability of proposed projects." The additional costs noted above would be small. Furthermore, as discussed for the No Action Alternative in Section 4.3.1.2.5, Impacts on Public or Private Resources, local governments have the option of passing on the costs of NFIP permitting to project proponents. The small additional costs to project proponents would be considered part of their routine costs of business in obtaining permits for projects and therefore would not materially impact the viability of proposed projects. Therefore, the impact of this component would be less than significant.

Any documentation costs experienced by communities are administrative costs that only affect local government or might be passed on to project proponents as small increments to existing permitting costs. They would not affect the costs of flood insurance, alter employment or tax revenues, change housing characteristics or development patterns, alter population growth or demographic patterns, alter ecosystem services, compromise public health or safety services, or cause disproportionately high and adverse human health or environmental effects on environmental justice populations. Therefore, this component of Alternative 2 would have no impacts on those aspects of socioeconomic resources.

4.3.1.3.4 LOMC Clarification

This component of Alternative 2 would clarify that the issuing of certain LOMC requests (i.e., map revisions) is contingent on the community or project proponent submitting documentation of compliance with the ESA, as required under the minimum floodplain management criteria clarification. Communities currently have to provide assurance of compliance with the ESA. Under this component of Alternative 2, they would also have to provide the ESA documentation to FEMA. Most communities or project proponents would incur costs to submit documentation to FEMA. The associated benefits would be improved clarity to help communities understand the requirements they must follow and how FEMA will process map change requests.

As noted above for the Floodplain Management Criteria Guidance component, the impact of documentation costs on local government and project proponents depends on several factors: in this case, the number of LOMCs and staff time required to submit documentation. The time required for these functions should in most cases be low since project proponents should already be obtaining documentation, and communities should be reviewing the documentation, to ensure compliance with the ESA. Local governments would have the option of passing on any additional costs to project proponents through the permitting process to develop in the floodplain, although in practice most NFIP communities already pass on all the documentation responsibilities associated with LOMCs to the project proponents.

As with the Floodplain Management Criteria Guidance component, the additional resource demands on local government and project proponents would be relatively small. Those demands would be highly unlikely to substantially interfere with the performance of other local government functions. If the costs are passed on to project proponents through the costs of obtaining a permit to develop in the floodplain, the small additional costs would be considered part of their routine costs of business in obtaining permits for projects and therefore would not materially impact the viability of proposed projects. Therefore, the impact of this component on public or private resources would be less than significant.

In addition, documentation costs are a very limited type of impact; they are very small administrative cost, and would not have a significant impact regardless of whether they are borne by the local government or project proponents. Documentation costs would not affect the costs of flood insurance, alter employment or tax revenues, change housing characteristics or development patterns, alter population growth or demographic patterns, alter ecosystem services, compromise public health or safety services, or cause disproportionately high and adverse human health or environmental effects on environmental justice populations. Therefore, this component of Alternative 2 would have no impacts on those aspects of socioeconomic resources.

4.3.1.3.5 Environmental Justice Impacts

The criterion for identifying significant environmental justice impacts is if the action results in disproportionately high and adverse human health or environmental (including economic) effects on minority populations or low income populations. The impacts must be adverse, and they must occur disproportionately to such impacts on the general population.

As discussed for the No Action Alternative, the literature is not clear on the propensity of minority and low income populations to be disproportionately located within flood zones. However, for Alternative 2, the key question is whether any minority and low income populations that are located in flood zones would be disproportionately affected by changes that would occur under Alternative 2—most importantly, increases to flood insurance costs due to phase-out of subsidies.

A recent study by Nance (2015) set out a framework for researching the question and applied the framework to Harris and Galveston Counties in Texas. Nance compared land price reductions (LPRs) in the real estate market data for zip codes in those counties in the two years after the enactment of BW-12 and the two years before enactment, and looked at minority and low income population data in affected zip codes. (Nance, 2015)

LPRs indicate a destabilized or declining real estate market. Nance found that 17 out of 142 zip codes experienced statistically significant increases in LPRs. All but 2 of the 17 were located near major waterbodies, all had portions with flood zones AE, VE, and Coastal A, and most had dense clusters of pre-FIRM properties (Nance, 2015). All these findings support the hypothesis that BW-12 was responsible for the negative effects on property values in the 17 zip codes.

Nance went on to assess whether the impacted zip codes were overrepresented by minority or low income populations. Nance found that "Among the significantly impacted zip codes, low income households were overrepresented by 11 percent in Harris County and by 32 percent in Galveston County; and minorities were overrepresented by 43 percent in Galveston." Nance concluded "These results support the hypothesis that flood insurance reform can have disproportionate impacts." (Nance, 2015)

Nance's study is suggestive but not conclusive. It showed an association between adverse property value impacts and environmental justice populations at the zip code level, but it did not directly show that the properties that experienced impacts were pre-FIRM properties, or that among pre-FIRM adversely affected properties, minority or low income households were impacted. Household-level data that could show such relationships is not available.

While FEMA has not examined relationships between income or minority status and pre-FIRM policyholders, FEMA utilized data from the U.S. Census Bureau for a high-level characterization of the income levels of policyholders. FEMA's analysis estimated that in 2015, only 6 percent of policyholders inside the SFHA and 4 percent of policyholders outside the SFHA qualify as "extremely low income" according to U.S. Department of Housing and Urban Development (HUD) standards. An additional 7 percent of policyholders inside the SFHA and 6 percent of policyholders outside the SFHA qualify as "very low income" under HUD standards. The extremely low and very low income categories mostly align with the poverty thresholds of the U.S. Census Bureau, which are the basis for identifying low income populations for environmental justice purposes.[35] However, FEMA's analysis is not broken out to

[35] HUD's income standards are based on Area Median Income (AMI), typically defined at the county or metropolitan area level. This income measure incorporates variations in incomes and cost of living across the country, while the poverty thresholds are uniform across the nation. Very low income is defined as 30 to 50 percent of the AMI. Extremely low income is defined as less than 30 percent of the AMI, but also interacts with poverty thresholds to include very low income families in areas where the poverty threshold is above the 30 percent level (U.S. Department of Housing and Urban Development, 2016). Given this approach, the very low income definition includes some families that are in poverty and some that are not.

what percentage of these low-income policyholders are owners of pre-FIRM properties impacted by the premium rate increases.

Based on the available evidence, FEMA believes that some environmental justice populations—specifically, low income populations—may feel the effects of increases in flood insurance costs more than other populations within some areas. However, as described above, the percentages of policyholders who qualify as low income according to environmental justice guidelines are relatively small on a nationwide basis. The percentages may vary from area to area. Effects of increases in flood insurance costs on low income populations are matters of affordability and are best addressed in that context. FEMA's current work to develop a congressionally required affordability framework may provide additional data regarding any such effects and possible approaches to reducing those effects. Therefore, environmental justice impacts associated with adverse impacts to Economic Characteristics (Costs of Flood Insurance) from the legislatively required phase-outs of pre-FIRM subsidies under Alternative 2 are possible but in the context of this NPEIS are considered less than significant. The development of a monthly installment plan payment option would not raise environmental justice concerns because this action would not have any adverse effects, and its benefits would be equally available to all eligible policyholders. The less than significant impacts on public or private resources from the documentation requirements of the floodplain management criteria guidance, or the documentation requirements associated with LOMC requests, would not disproportionately affect minority or low income populations as the same administrative costs associated with the documentation requirements would apply to all communities. Moreover, because the costs of these documentation requirements are low, they are unlikely to have disproportionate impacts on minority and low income communities.. Therefore, those components of Alternative 2 would have no impact on Environmental Justice.

4.3.1.3.6 Summary of Impacts

The analyses above found that some components of Alternative 2 would have less than significant impacts on Economic Characteristics (Costs of Flood Insurance), Economic Characteristics (Employment or Tax Revenues), Housing Characteristics, Public or Private Resources, and Environmental Justice. Alternative 2 would have no discernable impacts on Population Growth or Demographic Patterns, Ecosystem Services, or Public Health and Safety Services.

While the overall impacts of Alternative 2 would be less than significant, FEMA recognizes that increased premiums due to phase-out of pre-FIRM subsidies could be difficult for some policyholders. FEMA is currently working on the congressionally required affordability framework that will help the agency formulate approaches to reduce difficulties that some policyholders may experience.

At the present time, the following actions would be available to potentially reduce the financial impact of premium rate increases:

- Communities can join the CRS program and take additional actions—beyond the requirements in the minimum floodplain management criteria—to improve their CRS classification and thereby the level of premium discounts available to policyholders in the community.
- The monthly installment plan payment option can improve cash flow for eligible policyholders (those who do not already have escrowed premiums) compared to a single large annual premium payment.

- FEMA is able to use discretion when determining premium rate increases under the second component of this alternative, which allows the annual premium increase to range from 5 to 15 percent per risk classification for those policies not affected by a mandatory 25 percent annual increase in premium. FEMA also has some discretion with respect to the amount of the Reserve Fund Assessment imposed under the current implementation of the NFIP.
- Policyholders can select a high deductible, which reduces the premium amount compared to a lower deductible. For example, FEMA makes a $10,000 deductible option available to policyholders. (FEMA, 2015a). The difference between the premium rate for $10,000 and $2,000 deductibles for a pre-FIRM subsidized single-family building-only policy is 30 percent. However, differences for other premium levels and types of policies vary (FEMA, 2016c).
- Policyholders can relocate to a non-SFHA area where flood risk and flood insurance premiums are lower.
- Policyholders can take actions, such as elevating insured structures, to mitigate the risk of flood loss to their property and thereby reduce flood insurance premiums.

4.3.1.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

Alternative 3 includes the legislatively required changes, the Floodplain Management Criteria clarification and associated LOMC clarification to the current implementation of the NFIP identified under Alternative 2, as well as the addition of proposed ESA Regulatory Changes that would (a) incorporate an ESA-related performance standard into the minimum floodplain management criteria at 44 C.F.R. § 60.3; (b) clarify the exception to the no-rise performance standard in the floodway; and (c) increase the probation surcharge.

4.3.1.4.1 Legislatively Required Changes and LOMC Clarification

The impacts for the following portions of this alternative would be the same as those described in Alternative 2:

- Legislatively Required Change: Phase-Out Subsidies on Certain Pre-FIRM Properties;
- Legislatively Required Change: Phase-Out Subsidies on All Other Pre-FIRM Properties;
- Legislatively Required Change: Develop a Monthly Installment Plan Payment Option; and
- LOMC Clarification.

4.3.1.4.2 Proposed ESA Regulatory Changes: New ESA-Related Performance Standard

FEMA would establish a new ESA-related performance standard in the minimum floodplain management criteria at 44 C.F.R. § 60.3 that would require communities to obtain and maintain documentation that any adverse impacts caused by proposed development, including fill, to ESA-listed species and designated critical habitat will be mitigated to the maximum extent possible. Under 44 C.F.R. § 60.3(a)(2), a community is currently required to review proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law. This includes compliance with the ESA. The new ESA-related performance standard would focus communities' awareness of the ESA, establish an ESA documentation requirement across all NFIP communities, and provide a means for FEMA to more effectively monitor communities' review and mitigation of the potential impact of development in the SFHA on ESA-listed species and designated critical habitats.

Communities wishing to continue their participation in the NFIP would incur costs to incorporate the ESA-related criteria identified in the proposed performance standard into their local ordinances. Community incorporation of the ESA-related floodplain management criteria into their local ordinances may be more or less costly depending on the rigor of the adoption process, the complexity of the local ordinances, as well as other complicating factors (e.g., population size, contentiousness of the change, or political climate). FEMA reached out to a selection of communities to develop estimates of the potential costs of incorporating the ESA-related criteria. Based on this community input, FEMA estimates that costs would range from approximately $1,000 to $2,000 for communities with populations of 5,000 or below, to approximately $15,000 to $40,000 for communities with populations above 100,000 (Appendix I) (FEMA, 2016h). While these are measurable impacts on each affected community, they do not rise to the threshold of the significance criterion "Requires an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions." As a reference point, the average budget (total direct expenditures) in 2012 of municipal and town governments representing populations of 5,000 or below was $1.13M (U.S. Census Bureau, 2016c). The estimated one-time ordinance incorporation cost of $2,000 would be 0.18 percent of the average budget for these governments. A one-time ordinance incorporation cost of $40,000 would be 0.02 percent of the average budget ($273.93M) of municipal and town governments representing populations of 100,001–200,000 in the United States (U.S. Census Bureau, 2016c). Therefore, the impact on public or private resources from incorporating the ESA-related criteria in the proposed performance standard into their local ordinances would be less than significant.

The proposed rule would require that an adverse impact be mitigated in the following order: (1) avoidance, (2) minimization, and (3) restoration or appropriate compensation unless the development proposal has mitigation measures approved by the Services. Since communities would have the option of satisfying the mitigation requirements of the new ESA-related performance standard through a Section 10 incidental take permit, or a Section 7 incidental take statement obtained through another Federal agency, any project proponents with projects that would already be in compliance with the ESA would not be subject to any additional requirements. FEMA assumes, as a starting point for analysis of the impacts of the new standard, that project proponents are already in compliance with the ESA, and the only increase in cost would be for communities to retain their documentation of compliance (discussed below), if they are not doing so already.

However, to the extent that projects are not already in compliance with the ESA in the absence of this program change, or if project proponents choose to comply with the performance standard itself instead of the ESA, the proposed rule could result in increased costs to proponents and perhaps to communities. These costs could include:

- Researching (using the Internet or field research) to determine if ESA-listed species or designated critical habitat are present;

- Conducting project area species and/or habitat surveys to determine if there are potential affects to ESA-listed species or designated critical habitat (if ESA-listed species or habitat are present);
- Developing environmental documentation to demonstrate ESA compliance (biological assessment or evaluation);
- Procuring incidental take permit or incidental take statement to document ESA compliance;
- Implementing mitigation measures that may address any adverse impacts to ESA-listed species or designated critical habitat (if there are any potential impacts to ESA-listed species or designated critical habitat); and
- Filing or storing of ESA documentation records.

The extent of these costs would depend on the following factors:

- The number of development proposals;
- The number of proposals that would not otherwise be in compliance with the ESA;
- The number of proposals for which the community or project proponents choose to seek compliance through the performance standard itself;
- The various methods of documenting that no ESA-listed species or designated critical habitats are present in the project area, the costs for each method, and the rate at which each method is used;
- For some proposals, where ESA-listed species or designated critical habitats are present, but there are no direct, indirect, or cumulative adverse impacts, the manner and cost of assessing the potential for impacts and documenting the lack of impacts;
- For other proposals, where there is a need to mitigate impacts to an endangered species, the manner and cost of creating, documenting, and implementing a mitigation plan; and
- Additional costs to the community for reviewing the above information.

Under the existing floodplain minimum criteria, a community is required to review proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law (44 C.F.R. § 60.3(a)(2)), including for compliance with the ESA. As such, communities should already be ensuring that proposed floodplain development is ESA-compliant. Accordingly, FEMA believes the number of projects and communities that would experience substantial additional costs due to the factors listed above is relatively small. Therefore, the significance criterion of requiring "an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions or the viability of proposed projects" would not be met, and the impacts on public or private resources related to compliance with the ESA or the performance standard itself would be less than significant.

A change from current requirements in terms of socioeconomic impacts on communities—as with the floodplain management guidance criteria of Alternative 2—is the requirement that communities obtain and maintain documentation of compliance. Communities (local governments) would incur costs to do so.

As with Alternative 2, under this component of Alternative 3 the impacts of documentation costs on local government depend on several factors. First, costs depend on the number of development proposals. Second, undoubtedly some communities already retain the necessary documentation, but the retention rate among communities is not known. Third, those communities that do not already retain documentation would incur some costs to do so. This would include costs of reviewing, processing, filing, and maintaining documentation as well as validating that the Services were provided an opportunity to review as appropriate. This increased burden is probably small; FEMA anticipates that, in most cases, communities would simply check to ensure there is sufficient documentation and place a copy of that information into an existing file (FEMA, 2016h).

Based on the same factors described in Alternative 2—the small average number of development proposals per community, the likelihood that some portion of the communities already maintain documentation, and the low resource requirement per proposal to maintain documentation—it is highly unlikely that this component of Alternative 2 would meet the "substantial interference" threshold of the public or private resources significance criterion. In short, the impact of this component of Alternative 3 would be less than significant.

FEMA would monitor documentation compliance through Compliance Assistance Visits (CAVs) and Compliance Assistance Contacts (CACs). This monitoring would occur along with monitoring of other floodplain management criteria and FEMA anticipates that the total time spent with each community would not change. As such, there would be no additional community costs associated with monitoring compliance (Appendix I) (FEMA, 2016h).

As discussed above, because implementation of the new performance standard would typically involve only minor administrative costs, it would not affect the costs of flood insurance, alter employment or tax revenues, change housing characteristics, alter population or demographic patterns, alter ecosystem services, or compromise public health or safety services. Therefore, this component of Alternative 3 would have no impacts on those aspects of socioeconomic resources.

4.3.1.4.3 Proposed ESA Regulatory Changes: Clarify the Exception to the No-Rise Performance Standard in the Floodway

Under this component of Alternative 3, the current NFIP floodplain management regulations would also be clarified to state that the current exception to the no-rise performance standard in the floodway applies only to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. All other projects, such as residential and commercial development, would not be allowed to cause a rise in the floodway.

Currently, 10,152 communities have established floodways under 44 C.F.R. § 60.3(d) that would be subject to this provision. Not all communities allow encroachments in the floodway, and of those that do, not all allow a rise in BFE. Those communities that do not allow encroachments in the floodway or only allow "no rise" encroachments may not need to take any action. For communities that do allow floodway encroachments resulting in a rise in BFE, the Chief Executive Officer would have to provide written assurance that the development is for a public purpose. FEMA floodplain management subject matter experts estimate that 75 percent of communities do not allow encroachments resulting in a rise in BFE in the floodway. This would result in only 2,538 communities (10,152 x (1-0.75) = 2,538) needing to incorporate associated changes into their local ordinances. FEMA anticipates that such impacted communities would make any necessary changes to their local ordinances in conjunction with other necessary changes and thus not incur additional adoption costs. At the project level, FEMA believes communities will be able to determine if a proposal is for a public purpose, and provide written assurance of this to FEMA, within current development review and assurance processes; thus, there would be no additional costs within those processes (Appendix J). (FEMA, 2016g)

FEMA also anticipates that all communities with floodways would experience a small one-time cost to become familiar with the public purpose term and how it may potentially impact their community. FEMA estimates that an official in each community would spend one hour to become familiar with the term and how it fits into their process (Appendix J) (FEMA, 2016g). Based on this low resource requirement, the impact of this component of Alternative 3 on public or private resources would be less than significant.

While this component of Alternative 3 limits non-public purpose development in the floodway to no-rise projects, it would not reduce local economic development. FEMA estimates that only 15 non-public purpose projects per year that currently qualify for the exception to the no-rise performance standard would no longer qualify for that exception (Appendix J) (FEMA, 2016g). Nevertheless, those projects could still move forward and be built in the floodway using measures that would eliminate any rise in the floodway. Projects could also be moved out of the floodway. In such cases, the associated economic activity (e.g., jobs and income from construction, generation of tax revenues) and economic development benefits of such projects would still occur. Due to the limited amount of projects that would be affected by this clarification to the regulations, there would be no adverse impacts to Economic Characteristics (Employment or Tax Revenues), Housing Characteristics, Population Growth or Demographic Patterns, and Ecosystem Services.

To the extent that some of the 15 non-public purpose projects per year that currently qualify for the exception to the no-rise performance standard are moved out of the floodway, local economies would benefit. Communities that maintain open space along rivers and other waterbodies have been show to enjoy strong property values, local economic activity, and overall quality of life (National Park Service, 1995). In addition, such areas maintain or improve ecosystem services that benefit humans—for instance, flood water retention services of floodplains that reduce downstream flood damages, and ground water recharge services that support water supplies. Specifically, an intact or restored floodplain, which includes floodways, reduces flood event severity because many of the normal hydrologic and biologic functions of natural floodplains act to mitigate the intensity, extent, and damaging aspects of flooding. As described in FEMA's publication *The Natural and Beneficial Functions of Floodplains* (FEMA, 2002), restored floodplains may provide flood storage and conveyance; reduction of flood velocities, peaks and sedimentation; promotion of water quality through filtering nutrients and impurities from runoff; and moderating of water temperature (see Table 2-1 in the report). Based on these considerations, Alternative 3 would have a beneficial impact on Ecosystem Services. Due to the very limited number of non-public purpose projects that would be affected, the impact would be negligible, and therefore less than significant.

4.3.1.4.4 Proposed ESA Regulatory Changes: Increase the Surcharge Applicable to Communities Placed on Probation

When a community is placed on probation due to deficiencies or violations in implementing or enforcing floodplain management regulations, an additional fee is added to each new or renewed flood insurance policy in the community for each year the community remains on probation. Under this component of Alternative 3, FEMA would increase the probation surcharge applicable to NFIP communities placed on probation from \$50 to \$100. Currently, 3 communities are on probation; they include a total of 549 policies. Using this information as well as the number of policies on probation between 2012 and 2014, FEMA estimates the number of policies subject to the surcharge would range between 400 and 600 with a primary estimate of 550 over the next 10 years. The resulting annual increase in surcharges ranges from \$20,000 and \$30,000 with a primary estimate of \$27,500 (\$50 surcharge increase x 550 policyholders subject to surcharge = \$27,500) per year. The benefit of increasing the probation surcharge is that it maintains its value as an enforcement tool by focusing policyholder attention on community non-compliance (National Research Council of the National Academies, 2015b).

Given the low magnitude of the impact on each policyholder (\$50 increase per policy per year) and the very limited prevalence of the surcharge (550 policies), the impact to Economic Characteristics (Costs of Flood Insurance) would be less than significant. There would be no impacts on any other significance criteria.

4.3.1.4.5 Environmental Justice Impacts

Several components of this alternative are identical to those in Alternative 2; therefore, their impacts on Environmental Justice would be the same as Alternative 2. These include less than significant impacts on Environmental Justice from the legislatively required phase-out of subsidies, and no impacts on Environmental Justice from development of a monthly installment plan payment option or from the documentation requirements associated with LOMC requests.

There is no reason to believe that the less than significant adverse impacts on public or private resources associated with clarifying the exception to the no-rise performance standard in the floodway—including the requirement on some communities for written assurance of the public purpose of permitted requirements, or the impacts associated with the estimated 15 non-public purpose projects per year that would no longer qualify for the exception to the no-rise performance standard—would fall disproportionately on minority or low income populations. Nor would the increased probation surcharge (which has a less than significant impact on Economic Characteristics (Costs of Flood Insurance)) be any more likely to be disproportionately imposed on such populations, and in any case the imposition of the surcharge is based factors each community should be able to control (deficiencies in implementing or enforcing floodplain management regulations). The requirement for communities to incorporate the new ESA-related performance standard into their local floodplain management ordinances, as shown in Section 4.3.1.4.2, constitutes such a small (and one-time) percentage cost to local government budgets that it would not constitute a significantly high and adverse impact on any communities with substantial environmental justice populations. With respect to the less than significant impact on public or private resources from the documentation requirements of the new ESA-related performance standard, this increased burden is also very small and therefore would not constitute a significant environmental justice impact. FEMA anticipates that, in most cases, communities would simply check to ensure there is sufficient documentation and place a copy of that information into an existing file.

However, if projects are not already in compliance with the ESA in the absence of this program change, or if project proponents choose to comply with the performance standard itself instead of the ESA, there might be additional mitigation costs. As discussed in Section 4.3.1.4.2, the assessment of costs for this change is based on an assumption that communities and project proponents are already complying with the ESA and other existing legal requirements. To the extent there is non-compliance with existing legal requirements, there could be additional costs (also discussed in Section 4.3.1.4.2). These mitigation costs would not disproportionately occur in minority or low income communities. However, the issue is whether there are disproportionate impacts of these additional costs on minority and low income communities. Some costs may be small enough to be absorbed by the community, regardless of whether that community is made up of a low income or minority population. However, costs could be significant for some projects and/or some communities. Nevertheless, FEMA expects that minority or low income communities are already substantially compliant with the ESA so that this program change, if implemented, would not have a significant impact on these communities. Therefore, the ESA-related performance standard component of Alternative 3 would have a less than significant impact on Environmental Justice.

4.3.1.4.6 Summary of Impacts

The analyses above found that some components of Alternative 3 would have a less than significant beneficial impacts for Ecosystem Services and less than significant impacts on Economic Characteristics (Costs of Flood Insurance), Economic Characteristics (Employment or Tax Revenues), Housing Characteristics, Public or Private Resources, and Environmental Justice. Alternative 3 would have no discernable impacts on Population Growth or Demographic Patterns or Public Health and Safety Services.

As with Alternative 2, any potential needs to reduce impacts under this alternative would be driven by the impacts resulting from increased premiums due to phase-out of pre-FIRM subsidies. The same actions outlined in Alternative 2 would be available to potentially reduce the financial impact of the premium increases in this alternative.

4.3.1.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

Alternative 4 includes the legislatively required changes, LOMC clarification to the current implementation of the NFIP, and ESA Guidance. Under the ESA Guidance, FEMA would use the existing performance standard in 60.3(a)(2) to implement a new policy/procedure requiring communities to obtain and maintain documentation that private floodplain development was undertaken in compliance with the ESA.

4.3.1.5.1 Legislatively Required Changes and LOMC Clarification

The impacts for the following portions of this alternative would be the same as those described in Alternative 2:

- Legislatively Required Change: Phase-Out Subsidies on Certain Pre-FIRM Properties;
- Legislatively Required Change: Phase-Out Subsidies on All Other Pre-FIRM Properties;
- Legislatively Required Change: Development of a Monthly Installment Plan Payment Option; and
- LOMC Clarification.

4.3.1.5.2 ESA Guidance Using the Existing Performance Standard

FEMA would use the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit to develop in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that the proposed floodplain development will be undertaken in compliance with the ESA.

To the extent that projects would not already be in compliance with the ESA in the absence of this program change, the guidance could result in increased costs to proponents and perhaps to communities. These costs could include:

- Researching (using the Internet or field research) to determine if ESA-listed species or designated critical habitat are present;
- Conducting project area species and/or habitat surveys to determine if there are potential affects to ESA-listed species or designated critical habitat (if ESA-listed species or habitat are present);
- Developing environmental documentation to demonstrate ESA compliance (biological assessment or evaluation);
- Procuring incidental take permit or incidental take statement to document ESA compliance;
- Implementing mitigation measures that may address any adverse impacts to ESA-listed species or designated critical habitat (if there are any potential impacts to ESA-listed species or designated critical habitat); and
- Filing or storing of ESA documentation records.

The extent of these costs would depend on the following factors:

- The number of development proposals;
- The number of proposals that would not otherwise be in compliance with the ESA;
- The number of proposals for which the community or project proponents choose to seek compliance through the performance standard itself;
- The various methods of documenting that no ESA-listed species or designated critical habitats are present in the project area, the costs for each method, and the rate at which each method is used;
- For some proposals, where ESA-listed species or designated critical habitats are present, but there are no direct, indirect, or cumulative adverse impacts, the manner and cost of assessing the potential for impacts and documenting the lack of impacts;
- For other proposals, where there is a need to mitigate impacts to an endangered species, the manner and cost of creating, documenting, and implementing a mitigation plan; and
- Additional costs to the community for reviewing the above information.

Under the existing floodplain minimum criteria, a community is required to review proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law (44 C.F.R. § 60.3(a)(2)), including for compliance with the ESA. As such, communities should already be ensuring that proposed floodplain development is ESA-compliant. Accordingly, FEMA believes the number of projects and communities that would experience substantial additional costs due to the factors listed above is relatively small. Therefore, the significance criterion of requiring "an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions or the viability of proposed projects" would not be met, and the impacts on public or private resources related to compliance with the ESA or the performance standard itself would be less than significant.

Assuming project proponents are in compliance with the ESA, a key change from current requirements in terms of socioeconomic impacts on communities would be to require communities to obtain and maintain documentation of compliance with the ESA. The impact of this documentation requirement of Alternative 4 on the public or private resources aspect of socioeconomics would be essentially the same as the documentation requirement of Alternative 3. This impact would be less than significant. Similarly, the documentation requirements under this component of Alternative 4 would have no impacts on other aspects of socioeconomic resources, and there would be no additional community costs associated with FEMA monitoring of documentation compliance through CAVs and CACs.

4.3.1.5.3 Environmental Justice Impacts

Several components of this alternative are identical to those in Alternative 2; therefore, their impacts on Environmental Justice would be the same as Alternative 2. These include less than significant impacts on Environmental Justice from the legislatively required phase-out of subsidies, and no impacts on Environmental Justice from development of a monthly installment plan payment option or from the documentation requirements associated with LOMC requests. With respect to implementing ESA guidance using the existing performance standard, the impacts on public or private resources would affect environmental justice populations in the same ways that the new ESA-Related Performance Standard under Alternative 3 would. Specifically, the documentation costs would be too small to constitute significantly high and adverse impacts on these populations.

However, if projects are not already in compliance with the ESA in the absence of this program change, there might be additional mitigation costs. As discussed in Section 4.3.1.5.2, the assessment of costs for this change is based on an assumption that communities and project proponents are already complying with the ESA and other existing legal requirements. To the extent there is non-compliance with existing legal requirements, there could be additional costs (also discussed in Section 4.3.1.5.2). These mitigation costs would not disproportionately occur in minority or low income communities. However, the issue is whether there are disproportionate impacts of these additional costs on minority and low income communities. Some costs may be small enough to be absorbed by the community, regardless of whether that community is comprised of a low income or minority population. However, costs could be significant for some projects and/or some communities. Nevertheless, FEMA expects that minority or low income communities are already substantially compliant with the ESA so that this program change, if implemented, would not have a significant impact on these communities. Therefore, the ESA Guidance component of Alternative 4 would have a less than significant impact on Environmental Justice.

4.3.1.5.4 Summary of Impacts

The analyses above found that some components of Alternative 4 would have less than significant impacts on Economic Characteristics (Costs of Flood Insurance), Economic Characteristics (Employment or Tax Revenues), Housing Characteristics, Public or Private Resources, and Environmental Justice. Alternative 4 would have no discernable impacts on Population Growth or Demographic Patterns, Ecosystem Services, or on Public Health and Safety Services.

As with Alternative 2, any potential needs to reduce impacts under this alternative would be driven by the impacts resulting from increased premiums due to phase-out of pre-FIRM subsidies. The same actions outlined in Alternative 2 would be available to potentially reduce the financial impact of the premium increases in this alternative.

4.3.2 Land Use and Planning

4.3.2.1 Significance Criteria

An evaluation of land use impacts involves a comparison of current and future proposed land uses and a determination of the extent to which the alternatives may be incompatible with these uses. There is the potential for a land use impact to occur when an activity directly or indirectly alters existing or planned land use. An alternative would result in adverse impacts on land use and planning if it:

- Significantly changes or conflicts with existing land use plans or other community plans or policies.

This NPEIS analysis reviews the potential land use impact for the alternatives. Table 4-14 provides a summary of the potential land use impacts.

Table 4-14: Potential Land Use and Planning Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Changes or Conflicts with Existing Land Use Plans or other Community Plans or Policies	Less than significant	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial

4.3.2.2 Alternative 1 (No Action Alternative)

The following assessment of the No Action Alternative addresses the significance criteria, highlighting the aspects of the current implementation of the NFIP that are most relevant to the criteria. This is because the NFIP has many aspects, only some of which are relevant to land use and planning and appropriately addressed by application of the land use and planning criteria. The action alternatives, in contrast, each include a limited number of components, so it is more appropriate to organize those evaluations by the components of the alternatives.

The NFIP makes Federal flood insurance available to property owners or lessees for participating communities. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities, not FEMA, are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations requires land use authority. The regulation of land use falls under each State's police powers, which the Constitution reserves to the States; the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level, by the community not FEMA, through the community's floodplain management regulations and permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, reviewing the proposed development to ensure compliance with their floodplain management ordinances, and verifying that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP. Under the No Action Alternative, FEMA would continue to administer the current policies, rules, and regulations of the NFIP.

However, there are certain aspects of the implementation of the NFIP that may influence a community's land use plans. State and local communities plan and regulate land use and development through zoning. Through the NFIP, FEMA sets certain nationally applicable minimum floodplain management criteria related to reducing flood hazard risk in floodplain areas for all NFIP participating communities. Based on 44 C.F.R. § 60 (Emergency Management and Assistance—Criteria for Land Management and Use), Federal flood insurance shall not be sold or renewed within a community unless the community has adopted adequate floodplain management regulations consistent with Federal criteria (44 C.F.R. § 60.1(a)). Participating NFIP communities adopt regulations that implement floodplain management criteria that are designed to reduce risk to structures located in the floodplain. Communities that participate in the NFIP adopt ordinances to guide development in floodplain areas. The updated ordinances, which incorporate the NFIP minimum standards, may be higher than the ordinances in place prior to the community joining the NFIP. The communities incorporate these ordinances into land use plans and policies to reflect the adopted ordinances and requirements. These community ordinances affect land use in floodplains of NFIP-participating communities by requiring development to meet specific performance standards designed to reduce flood hazard risk and losses during flood events (FEMA, 2015b). These requirements may influence the cost and design of future developments. Because there are many factors influencing land use plan decisions, of which FEMA's floodplain management requirements are one, implementation of these requirements has a less than significant impact on a community's existing land use plan.

Another component of the NFIP that could affect community land use plans is flood hazard mapping. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Mapping of flood hazards promotes public awareness of the degree of hazard within such areas and provides for the expeditious identification and dissemination of flood hazard information. The flood maps are accessed frequently for planning and design activities and for lending and real estate transactions. They are used by mortgage lenders, insurers, real estate agents, map determination companies, community officials, land developers, engineers and surveyors, State and local emergency response officials, and property owners. The flood maps are also used by States and communities for land-use and water resources planning. By promoting public awareness of the flood hazard, FEMA flood maps may encourage communities to revise their land use plans to take into account these flood hazards and to adopt land use plans that minimize development in flood hazard areas. However, given that FEMA flood maps only provide information to communities to take such actions, and do not require communities to do so, the impacts of FEMA flood hazard maps on existing land use plans would be less than significant.

Another component of the NFIP that could affect community land use plans is the CRS. The CRS is a voluntary program that provides flood insurance premium discounts to flood insurance policyholders in communities implementing floodplain management programs that exceed the minimum NFIP standards, as described in Section 4.1.1.2. The CRS provides two important opportunities to participating communities. First, it recognizes those communities that are implementing floodplain management practices that achieve greater flood damage reduction than available through the minimum floodplain management criteria of the NFIP. Secondly, it provides an incentive to communities to implement floodplain management practices in the future that will lead to flood insurance premium discounts.

The CRS encourages the use of higher minimum floodplain management criteria for communities to proactively protect their citizens and businesses from flooding. The CRS recognizes, fosters, and rewards—through use of flood insurance premium discounts—community and State activities that go beyond the minimum requirements of the NFIP to:

- Reduce and avoid flood damage to people and property;
- Strengthen and support the NFIP insurance program; and
- Foster comprehensive floodplain management planning.

There are nine CRS classes that provide a flood insurance premium discount. A CRS rating of a Class 9 provides a five percent premium discount to flood insurance policies in the SFHA. As a community engages in additional floodplain management activities, their rating improves in 500-point increments. A CRS Class 1 is the most advanced CRS Class rating, and policyholders in communities in this class are afforded a 45 percent premium discount.

The CRS provides a unique opportunity to motivate communities that desire to use the insurance premium discount program as an incentive and justification for forward-looking comprehensive land use planning. The NFIP minimum floodplain management standards described in described in Section 1.3.1.1 are applicable nationwide. However, for certain communities with more complex flood risk, these minimum standards may only be appropriate as a starting point for a more comprehensive approach to land use planning and flood control measures. Flooding characteristics faced by communities vary greatly across the nation. Land-use patterns, urbanization, extreme coastal flood risk, subsidence, erosion risk, population demographics, and community capability can all vary widely for communities. The CRS provides an opportunity for individual communities to undertake planning strategies, evaluate their flood risk, implement best practices, and, in exchange, to receive flood insurance premium discounts for policyholders in CRS communities.

Through multi-year strategies, CRS communities can plan floodplain management initiatives that influence land-use planning and lead to safer occupancy of floodplain areas. For most CRS communities, community planning includes development limitations in floodprone areas and the preservation of open space. As of October 2016, there were 1,416 NFIP participating communities that participate in the CRS, which includes approximately 69 percent of all NFIP policies. Many of these CRS communities are communities with very large numbers of flood insurance policies and communities in locations undergoing a pattern of new development in floodprone areas. Many CRS communities in the "introductory" CRS Classes, i.e., Class 9 and Class 8, are implementing floodplain management programs that exceed the minimum NFIP floodplain management standards by a minimal or marginal degree. There are 701 CRS Class 9 and 8 communities. However, as communities progress through more advanced CRS Classes into the "advanced" level classes, i.e., CRS Class 5 through 1, their floodplain management programs are more strategic, comprehensive and effective in reducing flood damages. The CRS provides a logical path for communities that want to advance their floodplain management programs and they incorporate a multi-year planning process to achieve their goals.

There are several of the CRS activities identified by FEMA that influence land use development and planning. Open Space Preservation, CRS Activity 420, is an effective way to prevent flood damage by keeping floodprone areas as undeveloped and open space (land with no buildings, pavement, barriers, etc.). Communities receive CRS credit when wetlands, natural areas, and beaches are protected from development. Even more CRS credits are provided when the areas preserved as open space are located within an SFHA or are deeded to restrict development for future years. Additional credit is also offered when measures are implemented that require or encourage less development, such as open-space incentives, low density zoning, and natural shoreline protection credit programs. This activity supports the designation of areas to be preserved as open space, which is a prominent element of community land use planning. Open space can achieve numerous benefits including water quality protection, storm water runoff control, aquifer and well water protection, wildlife habitat conservation, retention of residential property values, outdoor recreation enhancements, to name a few.

Higher Regulatory Standards, CRS Activity 430, recognizes community higher standards. In areas where there is recurring flood damage, there are associated high rates of business foreclosure, costly effects upon emergency services, and unstable housing resources. These are the very kinds of undesired consequences that land use planning seeks to avoid, and use of higher regulatory standards for new construction is one way to help avoid such adverse consequences (FEMA, 2005) (FEMA, 2015b).

Examples of higher standards that are incorporated into community land use planning by CRS communities, and the benefits that they can provide, include the following:

- Prohibiting fill and other ground-altering measures can protect existing development and habitat, improve water quality, and maintain the flood attenuating benefits of natural areas;
- Requiring compensatory storage preserves areas of the floodplain that can store flood water and minimizes increases in flood heights due to development;
- Requiring the lowest floors of residences to be higher than the base flood elevation protects buildings from higher floods;
- Requiring full compliance with floodplain management regulations when proposed improvements or repairs are less than 50 percent of a building's value brings more nonconforming buildings up to current flood protection standards;
- Protecting critical facilities to higher levels reduces damage to those facilities and improves the community's ability to respond to the needs of citizens during a disaster;
- Adopting and enforcing a building code improves the quality of construction of new buildings and provides more staff support for floodplain management regulations;
- Standards for protecting buildings from local drainage problems reduce flood losses and flood insurance claims, especially outside the floodplain;
- Requiring new manufactured housing in existing manufactured housing parks to meet the same level of protection as is required for other new buildings reduces flood losses and flood insurance claims;
- Requiring new construction in the coastal A Zone to meet the same standards as V-Zone buildings protects it from a known, but unmapped, breaking wave hazard; and
- Adopting and enforcing construction rules tailored to special flood-related hazards, such as coastal erosion and alluvial fan flooding, provides protection in ways that the NFIP's national minimum criteria cannot do.

Stormwater Management, CRS Activity 450, provides CRS credits to communities that use one of the following approaches to stormwater management: (1) regulating each activity to ensure peak flow runoff from a project site does not increase from the project's baseline before development; (2) regulating development according to a watershed master plan that analyzes the combined effects of existing and expected development on drainage throughout the watershed; (3) controlling erosion and sediment to protect nearby watersheds; (4) requiring new development to be elevated above the BFE; and (5) requiring new developments' stormwater management facilities to improve the quality of stormwater runoff (FEMA, 2013b). The objective of this activity is to prevent future development from increasing flood hazards to existing development and to maintain and improve water quality. When unmanaged, stormwater runoff from new development throughout a watershed can affect floodplains by causing more frequent flooding, greater flood depths, and longer-lasting floods. As forests, fields, and farms are covered by impermeable surfaces, such as streets, rooftops, and parking lots, more of the rain runs off and it runs off at a faster rate. When an area is urbanized, the rate of runoff and the volume of runoff can increase five-fold or more.

Adequate stormwater management planning and investments support a community's use of deliberate land use planning to influence development patterns in a community. Typically, new development introduces new stormwater runoff patterns, but these can be managed as a component of land use planning to allow for the proper balance of use between developed areas with urbanizing characteristics and less urban areas suitable for less intense development.

It is very important to regulate new development to ensure that the peak flow and volume of stormwater runoff leaving a development site will be no greater than the runoff from the site before it was developed. Restrictions on individual developments can address many watershed development problems, but to prevent unwanted consequences from development as a whole, communities should plan on a watershed-wide basis.

By completing watershed master plans as part of a community's land use and planning efforts, communities can examine the potential impact of unmitigated development on streams and structures throughout the watershed. Once these impacts are known, a comprehensive program, including more specific development regulations, can be created to prevent adverse impacts. This will prevent an increase in flood damage or stream erosion, reductions in groundwater recharge or water quality, and loss of habitat.

The Floodplain Management Planning, CRS Activity 510, provides CRS credit for implementing one of the following types of plans:

- Floodplain Management Planning (FMP): The most credit is for the first element, a community-wide floodplain management plan, but the element can also credit multi-hazard mitigation plans, multi-jurisdictional floodplain management and hazard mitigation plans, and floodplain management plans prepared for the USACE.
- Repetitive Loss Area Analyses (RLAA): The second element credits more detailed, site-specific plans to reduce flood losses in repetitively flooded areas. It has a narrower scope than a floodplain management plan and receives fewer credit points.
- Natural Floodplain Functions Plan (NFP): The third element provides credit for plans that address natural floodplain functions in the community.

The CRS Activity 510 credit was designed around the well-proven framework seen in comprehensive planning that depends upon land use authorities to implement comprehensive plans. The objective of this activity is to credit the production of an overall strategy of programs, projects, and measures that will reduce the adverse impact of the hazard on the community and help meet other community needs. This activity was developed to address the problem that flood protection decisions are often made quickly, with inadequate or outdated information or without considering all possible mitigation alternatives or the consequences of those alternatives. As a result, the community's resources are not allocated most appropriately, flood problems may not be fully addressed, and natural floodplain functions may suffer.

To remedy this situation, a careful, systematic process of planning is required to earn credit under this activity category. The CRS does not specify what activities a plan must recommend. Rather, it recognizes plans that have been prepared according to the standard planning process explained in this activity. The CRS Floodplain Management Planning credit is based upon a prescribed ten-step process that includes public input, the development of recommendations, and community leadership endorsement leading to implementation.

Acquisition and Relocation, CRS Activity 520, and Flood Protection, CRS Activity 530, are two CRS activities that steer community leaders to making specific choices about land use, depending upon the flood risk severity and recurrence of flood damage. Under CRS Activity 520, Acquisition and Relocation, communities may choose to acquire and relocate buildings that have experienced, or are subject to, severe flood damage in exchange for CRS credit. Notably, credit is only provided if the community can document that the land, or the portion of the land within the regulatory floodplain, will remain vacant.

Conversely, under CRS Activity 530, Flood Protection, communities may have locations with improvements and infrastructure where the communities want to continue the existing use. Under these circumstances, a community may undertake the following measures to reduce the flood risk to such properties in exchange for CRS credit:

- Retrofitting the buildings so that they suffer no or minimal damage when flooded; and/or
- Constructing small flood control projects that reduce the risk of flood waters reaching the buildings.

In both of these instances—Acquisition/Relocation and Flood Protection—community leaders direct land use in flood prone areas. In one case, community leaders may determine the best land use is to relocate people and property away from the flood hazard through acquisition and relocation. In another case, they may determine the best land use is to continue use of the land, but with additional flood protection systems in place.

Floodplain regulations that exceed the minimum NFIP standards, such as the CRS, could act to restrain development in high hazard floodplains. The *Evaluation of the Economic, Social and Environmental Effects of Floodplain Regulations* (FEMA, 1981) found that as a result of floodplain management regulation, development is likely to be displaced to non-floodplain locations, generally within the same community, rather than foregone altogether. The conclusion of this study was based on projected impacts of different regulatory scenarios on future development in 21 case study communities across the nation. This conclusion held even in communities with developable land constraints such as steep topography. FEMA believes this finding would apply to the increased regulation associated with CRS as well. As such, despite the fact that implementation of CRS may act to restrain some floodplain development, it is unlikely to significantly alter or change a community's existing land use plans.

In summary, implementation of the NFIP would have less than significant effects on existing land use plans or community plans or policies.

4.3.2.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

The legislatively required changes to the NFIP's Flood Insurance under Alternative 2 would include the phasing out of subsidies for pre-FIRM properties and the implementation of an installment plan payment option. While increases in insurance premium rates may have a deterrent effect on development in the floodplain by some individuals due to the increased cost of flood insurance, it is unlikely premium rate increases would be significant enough, on a community-wide level, to drive more than minor changes to existing land use plans or community plans or policies. However, where the premium rate increases affect a substantial portion of the community, this could encourage more communities to either join the CRS program, or increase the amount of CRS-creditable activities. To the extent that such activities include, for example, involving the use of the community's land, such as the creation of open space, then the changes could result in minor and less than significant effects on land use plans or other community plans or policies.

Implementation of a monthly installment plan payment option for non-escrowed policyholders to pay for their flood insurance would not likely influence or drive changes in land use plans or other community plans or policies at a community-wide level. This change, if implemented, would only affect how a policyholder pays the premium on his or her flood insurance policy; it would not increase or decrease the overall levels of development or require the incorporation of new standards and practices into community ordinances that may require adjustments to a community's current land use plans.

Under Alternative 2, changes to clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain would be applied. This clarification of existing standards, laws, and regulations under the NFIP would not change or conflict with existing land use plans or other community plans or policies since these plans are based on existing standards, laws, and regulations. As a result, this clarification of FEMA's regulations and the associated documentation requirements would not change or conflict with existing land use plans or other community plans or policies.

Changes to the NFIP's Flood Hazard Mapping proposed under Alternative 2 would provide clarification that the issuing of certain letter map change (LOMC) requests (i.e., map revisions) is contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA, as required under the minimum floodplain management criteria clarification. These changes involve merely producing documentation of ESA compliance that should already have been ensured at the floodplain development permitting stage. Because the clarification to LOMC request procedures would not change existing standards, laws or regulations, and because the floodplain development in question has already occurred, this clarification would not change or conflict with existing land use plans or other community plans or policies. In sum, impacts to land use plans would be beneficial and less than significant through implementation of Alternative 2.

4.3.2.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for the legislatively required and mapping portions of this alternative would be the same as those described in Alternative 2 (Section 4.3.2.3). The impacts associated with the proposed ESA Regulatory Changes of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would establish a new ESA-related performance standard in the minimum floodplain management criteria at 44 C.F.R. § 60.3 that would require communities to obtain and maintain documentation to show that any adverse impacts caused by proposed development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, will be mitigated to the maximum extent possible.

Floodplain management is carried out at the State and local levels, where land use authority resides. The community regulates floodplain development through locally issued permits to develop in the floodplain. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the use of land in the community or the types of development that may occur in the floodplain. Likewise, each community monitors compliance and enforcement of individual permits. Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does the NFIP encourage such floodplain development.

While adoption of the ESA-related performance standard would not change the basic structure of the NFIP or increase FEMA's land use authority or influence in implementing the NFIP, it could encourage communities to take a more active role in ensuring floodplain development is ESA-compliant, which may, in turn, change or conflict with a community's existing land use plans. Applying improved ESA compliance standards would strengthen ESA compliance by requiring project proponents to identify, assess, address, and mitigate potential adverse impacts to ESA-listed species and designated critical habitats, including the natural floodplain functions that support them. This requirement could indirectly influence and encourage communities to adopt a more holistic land use planning approach to floodplain development that could reduce flood risk, improve floodplain management, and protect natural floodplain functions while also furthering the purposes of the ESA by conserving ESA-listed species and their habitat. As a result, the ESA-related performance standard could indirectly lead to revisions to existing land use plans or other community plans or policies that could have a beneficial impact to communities.

> King County, WA is an example of a community that is addressing its ESA responsibilities holistically. King County performed a study to address existing floodplain functions and habitat values along with foreseeable impacts (both beneficial and detrimental) to those functions and values from existing ordinances, master programs, State requirements, comprehensive plans, restoration projects, and future projects occur based on their land use regulations. This allowed King County to fully consider how their floodplain regulations and projects can affect the functions and values of their floodplain. Based on this information, King County developed floodplain regulations that holistically address ESA-listed species, and the natural floodplain functions that support them, in its jurisdiction. King County's materials are readily available on their website (http://www.kingcounty.gov/ depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/programmatic-habitat-assessment.aspx). Other jurisdictions that lack King County's level of resources and expertise have chosen to adopt the Model Ordinance Approach developed by FEMA in coordination with the National Marine Fisheries Service and the Washington communities. The Model Ordinance is a set of model ordinances—to be adopted into the community's ordinances—that comprehensively address ESA-listed species and their habitat, as well as the natural floodplain functions that support such species and habitat. Currently, there are five NFIP-participating communities in Washington that have adopted this approach—Auburn, City of Roy, City of Shoreline, Granite Falls, and Skokomish Reservation.

Under the ESA Regulatory Changes, the current NFIP floodplain management regulations would also be clarified to state that the current exception to the no-rise performance standard in the floodway applies only to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. Reinforcement of existing standards and clarifying exceptions would not alter existing land use plans or other community plans or policies since these plans are based on existing standards, laws, and regulations. Additionally, FEMA determined that the number of non-public purpose projects that were built in the floodway due to the lack of clarification that would be provided under this alternative – is 15 projects per year. Given the small number of projects likely to be impacted by this clarification, it is unlikely to alter a community's existing land use plans.

Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to policyholders in NFIP communities that have been placed on probation would be increased from $50 to $100. While such an amount may be somewhat effective in encouraging communities to come into compliance with floodplain management regulations, FEMA believes this amount would not be significant enough to promote actions that would alter a community's existing land use plans or other community plans or policies. Accordingly, there would be less than significant beneficial impact to land use and planning from the implementation of Alternative 3.

4.3.2.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for the legislatively required and LOMC clarifications of this alternative would be the same as those described in Alternative 2 (Section 4.3.2.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

Under Alternative 4, FEMA would use the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement a new policy/procedure requiring communities to ensure that, for any development in the floodplain for which a permit is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private development in the floodplain was undertaken in compliance with the ESA. Floodplain management is carried out at the State and local levels, where land use authority resides. The community regulates development in a floodplain through locally issued permits, and the community has the authority to issue or deny permits. Likewise, each community monitors compliance and enforcement of individual permits. Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does the NFIP encourage such development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the use of land in the community or the types of development that may occur in the floodplain.

While implementation of the new ESA Guidance would not change the basic structure of the NFIP or increase FEMA's land use authority or influence in implementing the NFIP, it could encourage communities to take a more active role in ensuring floodplain development is ESA-compliant, which may, in turn, change or conflict with a community's existing land use plans. Applying enhanced ESA documentation requirements could strengthen ESA compliance by requiring project proponents to identify and assess adverse impacts to ESA-listed species and designated critical habitats, and for those projects with potential adverse effects on ESA-listed species and their habitat, to produce documentation of ESA compliance to the community. This requirement could indirectly influence and encourage communities to adopt a more holistic approach to floodplain development that could reduce flood risk, improve floodplain management, and protect natural floodplain functions while also furthering the purposes of the ESA by conserving ESA-listed species and their habitat. Incorporating this more holistic approach to floodplain management could influence changes to existing land use plans or other community plans or policies. However, FEMA does not anticipate widespread community adoption of this holistic approach. As such, implementation of the ESA Guidance could indirectly lead to a less than significant beneficial impact to land use and planning in some cases.

4.3.3 Water Resources

4.3.3.1 Significance Criteria

Evaluation criteria for impacts on water resources are based on water quality; existence of floodplains; and associated regulations. An alternative would result in impacts on water resources if it does one or more of the following:

- Causes irreparable harm to aquatic life or beneficial uses of aquatic ecosystems;
- Modifies surface water or groundwater quality; or
- Modifies unique hydrologic characteristics, such as floodplain function.

Table 4-15 provides a summary of the potential water resources impacts.

Table 4-15: Potential Water Resources Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Causes irreparable harm to aquatic life or beneficial uses of aquatic ecosystems	No impact	No impact	No impact	No impact
Modifies surface water or groundwater quality	No impact	No impact	No impact	No impact
Modifies unique hydrologic characteristics, such as floodplain function	Less than significant beneficial	No impact	Less than significant beneficial	Less than significant beneficial

4.3.3.2 Alternative 1 (No Action Alternative)

The following assessment of the No Action Alternative addresses each of the significance criteria, highlighting the aspects of the current implementation of the NFIP that are most relevant to each of the criteria. This is because the NFIP has many aspects, only some of which are relevant to water resources and appropriately addressed by application of the water resources criteria. The action alternatives, in contrast, each include a limited number of components, so it is more appropriate to organize those evaluations by the components of the alternatives.

The NFIP makes Federal flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations, requires land use authority. The regulation of land use falls under each State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level through the community's floodplain management regulations and permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, and for reviewing the proposed development to ensure compliance with their floodplain management ordinances and that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. FEMA has no role in the issuance, denial, or enforcement of individual permits, nor does it have the land use authority necessary to prescribe the types of development that may take place in the floodplain. Therefore, private development in the floodplain and the issuance, denial, and enforcement of individual permits are not actions that are included within the No Action Alternative because these actions are not taken under the NFIP.

44 C.F.R. § 60.3(a)(2) Floodplain Management Criteria for Flood-Prone Areas

Minimum standards for communities are as follows:

(a) When the Federal Insurance Administrator has not defined the SFHAs within a community, has not provided water surface elevation data, and has not provided sufficient data to identify the floodway or coastal high hazard area, but the community has indicated the presence of such hazards by submitting an application to participate in the Program, the community shall:

(2) Review proposed development to assure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. § 1334 (CWA)

When floodplains are preserved in their natural state, they provide many benefits that range from providing habitat for fish and wildlife to reducing the number and severity of floods, helping handle stormwater runoff, minimizing non-point water pollution, providing floodwater storage and conveyance, and reducing flood velocities and flood peaks. Furthermore, these natural processes promoted by floodplains cost far less money than it would take to build facilities to correct flood, stormwater, water quality and other community problems. Because FEMA does not authorize, fund, carry out, or encourage floodplain development pursuant to the NFIP, an assessment of the impacts of implementing the NFIP does not include an assessment of the adverse impacts of private floodplain development on water resources. (FEMA, 2002)

However, there are certain aspects of the NFIP program that discourage development in flood hazard areas. The flood hazard mapping element of the NFIP, including publishing FIRMs and the administrative procedures for amending or revising them, involves using the best available data to delineate flood hazard zones. These actions are independent from floodplain development, so there would be no direct effects on water resources associated with such floodplain development. However, publishing FIRMs may help promote broad-based awareness among affected individuals of the risks associated with living in a floodplain, which could help guide development away from flood hazard areas. FEMA also provides best available data and, upon request from the community, future conditions maps. This information may then be used by communities to help establish future community zoning, land use, building standards, and higher floodplain management standards that will guide development away from flood hazard areas. By encouraging development outside of flood hazard areas, the implementation of the NFIP benefits water resources by promoting the retention of floodplains in their natural state; maintaining aquatic ecosystems, surface water and groundwater quality, and floodplain function with all the associated benefits discussed above.

Although FEMA does not have the land use authority to restrict development in floodplains, the minimum floodplain management criteria (44 C.F.R. § 60.3) include certain limitations to how such development is carried out that may benefit water resources. One of FEMA's minimum floodplain management criteria is 44 C.F.R. § 60.3(a)(2), which requires communities to ensure that all proposed floodplain development is compliant with Federal and State laws. To the extent that the FEMA requirement in 44 C.F.R. § 60.3(a)(2)—that communities are required to comply with Section 404 of the Clean Water Act (CWA) for all proposed floodplain development—increases compliance with the CWA, this requirement benefits water resources, including surface and groundwater quality, floodplain functions, and aquatic ecosystems, because the CWA was promulgated for the protection of these resources.

Also, the minimum criteria include a requirement that, where appropriate analysis has been conducted, encroachment in riverine floodways may not cause an increase in flood heights (subject to limited exceptions). This requirement helps protect hydraulic characteristics of the floodplain by allowing the floodway to function naturally during storm events without increasing flood levels within the community and by assisting in preventing degradation of surface and groundwater quality and protecting aquatic ecosystems. It was estimated that approximately 9,000 square miles of floodways have been protected by this requirement (AIR - Wetmore et al., 2006). Additionally, per 44 C.F.R. § 60.3(e)(3) and (e)(6), communities cannot locate new construction seaward of mean high tide (e.g., construction cannot occur over water) or place fill within coastal velocity zones (V Zones). Zones V1-30, VE, and/or V identified on FIRMs are considered coastal high hazard areas and subject to tidal surges, wave action, and high winds from storms and hurricanes. These minimum criteria requirements help protect against high water levels, erosion, and scour, which can undercut building foundations and cause degradation of water quality and impacts to aquatic ecosystems. Mangroves and sand dunes are also protected under FEMA's minimum floodplain management criteria. Before these areas may be altered, the community or project proponent must undertake an analysis to demonstrate that the proposed development activities would not increase potential flood damage. By limiting encroachment in mangroves and sand dunes, these natural features continue to protect the shoreline from coastal storms, reduce flood damage to communities, and benefit surface and groundwater quality and aquatic ecosystems.

Another component of the NFIP that could affect water resources is the CRS. The CRS also plays a key role in encouraging conservation of floodplains and retaining hydrologic characteristics such as floodplain functions, and therefore water resources within those floodplains, by offering flood insurance premium discounts to residents of communities that implement voluntary mitigation activities. Some of these activities may result in increased habitat and aquatic ecosystem protection beneficial to water resources within the floodplain. Under the CRS Program, FEMA has issued *CRS Credit for Habitat Protection* guidance to describe the types of habitat protection activities that are eligible for CRS credit, such as the inclusion of open space requirements, and in turn can result in flood insurance premium discounts. When communities create open space adjacent to bodies of water like rivers and streams, the natural and beneficial functions of floodplains are maintained, allowing streams to meander and collect woody debris, which in turn will support hydrologic characteristics such as floodplain functions and keep the floodwaters away from insurable structures (FEMA, 2010). Managing stormwater runoff can have beneficial impacts to water resources. FEMA's publication *CRS Credit for Habitat Protection* documents activities that communities can use to manage stormwater runoff to manage pollutants, flow volume and velocity, sediment loads, and infiltration – all things that are detrimental to water resources. CRS provides credits for these activities, encouraging communities to manage stormwater runoff and enhance water resources (FEMA, 2010).

Under the No Action Alternative, FEMA would continue the policies and program elements of the existing NFIP. As discussed above, the NFIP requires State and community compliance with applicable Federal and State laws. Additionally, the NFIP encourages communities to take a proactive role in the management and improvement of water resources through the implementation of the floodplain management criteria and the CRS program. Furthermore, the information provided in FEMA flood maps may be used by communities to guide development away from flood hazard areas. By discouraging development in flood hazard areas, the implementation of the NFIP benefits water resources by promoting the protection of aquatic ecosystems, water quality, and retention of hydrologic characteristics such as floodplain functions, in flood hazard areas. Based on the above analysis, implementation of the No Action Alternative would likely have an overall indirect beneficial, but insignificant, impacts on water resources, including aquatic ecosystems, surface water and groundwater quality, and hydrologic characteristics such as floodplain function.

4.3.3.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under Alternative 2, FEMA proposes to phase out existing subsidies on all pre-FIRM properties and implement an installment plan payment option.

Alternative 2 would not have significant impacts on water resources because the elements of Alternative 2 do not cause or encourage development, nor do they have any influence on how development or other activities are carried out in ways that could result in impacts to water resources.

The program modification to phase out subsidies would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders have policies that insure buildings that built prior to the community's first FIRM. As such, this program modification would primarily affect policyholders of policies on existing development. Because nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that join the NFIP in the future. The likelihood of a project proponent making a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote. Moreover, because this change is solely a change to the insurance rates of individuals, and not a change that influences how development is carried out or other activities that could impact water resources, this change would have no impact on water resources.

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, such that these policies would actually be more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to the mandatory purchase requirement since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of an installment plan would have the disposable income necessary to finance new development for any reason, much less for the purpose of taking advantage of this new payment option. Moreover, because this change is solely an administrative change to the insurance payment options of NFIP policyholders, and not a change that causes or encourages development, nor influences how development is carried out or other activities that could impact water resources, this change would have no impact on water resources.

The floodplain management criteria guidance portion of Alternative 2 includes changes to clarify that a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, prior to the issuance of permits to develop in the floodplain per 44 C.F.R. § 60.3(a)(2). Because the clarification to the minimum floodplain management criteria does not change the existing legal compliance requirements associated with permits to develop in the floodplain, but merely documents that such compliance is occurring, the change will have no impacts on water resources beyond those associated with implementation of the No Action Alternative.

Under the LOMC clarification portion of Alternative 2, the procedure for processing map change requests would be clarified to include a requirement that documentation of compliance with the ESA be provided as a condition of LOMC issuance. It is notable that the private floodplain development for which a map change request is sought has already taken place. Therefore, any legal compliance activities related to such development would have taken place before FEMA's involvement. Since the ESA documentation in question should have already been procured at the permitting stage for development in the floodplain, and the floodplain development for which a map change request is sought would have already occurred, this clarification would have no impact on water resources, including aquatic ecosystems, surface water and groundwater quality, and hydrologic characteristics such as floodplain function.

4.3.3.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the implementation of a monthly installment plan payment option for non-escrowed flood insurance would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.3.3.3). The impacts associated with the ESA Regulatory Changes portion of this alternative are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

Under the ESA Regulatory Changes, FEMA would establish a new ESA-related performance standard in the minimum floodplain management criteria at 44 C.F.R. § 60.3. Under this new ESA-related performance standard, communities would be required to obtain and maintain documentation to show that any adverse impacts caused by proposed development to ESA-listed species and designated critical habitat, including the natural and beneficial floodplain functions that support such species and habitat, have been assessed and mitigated to the maximum extent possible. FEMA would develop guidelines and/or a process for documenting community compliance with the ESA-related performance standard. Communities would be monitored for compliance with the new ESA-related performance standard, and FEMA would take enforcement actions against communities that do not adhere to it (through existing processes such as CAVs and CACs). While adoption of the ESA-related performance standard would not change the basic structure of the NFIP or increase FEMA's land use authority or influence in implementing the NFIP, it could encourage communities to take a more active role in ensuring floodplain development is ESA-compliant, which may, in turn, change the way a community approaches the management of its floodplains and water resources.

Compliance with the ESA ensures the protection of ESA-listed species and designated critical habitat, including floodplains that support such species and habitat. In a 1993 study, the USACE determined that the "preservation of floodplains along a river can reduce flood levels" and "is most effective at reducing flood peaks for floods of short duration" (USACE, 1993) (The Nature Conservancy, 2014a). Because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to reasonably ascertain whether this change would increase the levels of ESA compliance in NFIP participating communities. FEMA can ascertain that to the extent that there are significant levels of non-compliance with the ESA in those communities, this change would increase levels of compliance.

Under the proposed ESA Regulatory Changes, in the event that a community is not in compliance with the ESA and proposed development resulted in potential adverse impacts to ESA-listed species and designated critical habitat, including floodplain functions, communities would be required to ensure that any adverse impacts would be mitigated to the maximum extent possible. Avoiding development in the floodplain can provide a diverse range of water resource benefits, including flood storage and conveyance; reducing flood heights and velocities; reducing nonpoint source pollution through deposition and denitrification; facilitating groundwater recharge; reducing wave damage; and supporting fisheries, open space, and recreation (EPA, 2016) (The Nature Conservancy, 2014a). In cases where avoidance is not an option, minimizing development in the floodplain and associated habitat would still have similar beneficial results; however, the effect would be limited or reduced. Modifying the natural processes of the floodplain could lead to increased erosion (sedimentation), reduced water quality, and greater flood damage to surrounding infrastructure (The Nature Conservancy, 2014a). Restoring essential habitat through mitigation (e.g., wetland restoration, floodplain reconnection) would benefit terrestrial and aquatic species by re-establishing the natural vegetative cover and soil profile(s) and improving floodplain functions, including reducing surface runoff, decreasing nutrient pollution, and reducing peak flood levels (The Nature Conservancy, 2014a) (The Nature Conservancy, 2014b) (NOAA, 2016). Floodplain wetlands play a critical role in the life cycle of many riverine fishes, and "as such, the practice of floodplain wetland restoration has great potential for improving habitats for aquatic species and the survival of declining species" (Knight & Boyer, 2007). Based on the above analysis, the proposed change would have beneficial impacts on water resources, including aquatic ecosystems, surface water and groundwater quality, and hydrologic characteristics such as floodplain function, and its effects on water resources would be less than significant.

Under the ESA Regulatory Changes, current NFIP regulations would also be clarified to expressly state that an exception to the current no-rise performance standard in the floodway applies only to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. According to FEMA's estimates, the number of non-public purpose projects that were built in the floodway due to the lack of clarification that would be provided under this alternative is 15 projects per year). Because this program modification would impact so few projects, its effects on aquatic ecosystems, surface and groundwater quality, and hydrologic characteristics such as floodplain functions would be less than significant.

Also pursuant to the ESA Regulatory Changes, the probation surcharge applicable to policyholders in NFIP communities that have been put on probation would be increased from $50 to $100 under Alternative 3. No construction activities or other physical development would occur from implementing this new probation surcharge. As a result, there would be no floodplain development that could result in impacts to aquatic ecosystems, surface water and groundwater quality, and hydrologic characteristics such as floodplain function. Moreover, because this change is solely a minor change to the cost of the insurance policies in certain communities, and not a change that influences how development is carried out or other activities that could impact water resources, this change would have no impact on water resources.

4.3.3.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for phasing out subsidies on pre-FIRM properties and the development of a monthly installment plan payment option for non-escrowed flood insurance and mapping portions of this alternative would be the same as those described in Alternative 2. In addition, impacts from LOMC clarification would be the same as those described in Alternative 2 (Section 4.3.3.3). The impacts associated with the ESA Guidance portion of this alternative are described below.

In Alternative 4, for the ESA Guidance, FEMA would use the existing performance standard in 44 C.F.R. § 60.3(a)(2) to implement, through guidance, a new policy/procedure requiring communities to ensure that, for any floodplain development for which a permit for development in the floodplain is sought, the impacts to ESA-listed species and designated critical habitat are identified and assessed and, if there are any potential adverse impacts to such species and habitat as a result of such development, that the community obtain and maintain documentation that private floodplain development was undertaken in compliance with the ESA. However, unlike the ESA Regulatory Changes, the ESA Guidance would not include any guidance on the mitigation of adverse impacts that were documented and reported unless the Services identified a need for it. Monitoring and enforcement in communities would be through existing processes such as CAVs and CACs, and would ensure that the guidance was being followed and documentation of ESA compliance was being obtained and maintained by the communities.

Like the ESA-related performance standard, the ESA Guidance would give communities a larger stake in ensuring floodplain development is ESA-compliant, and would have guidelines and/or a process for documenting community compliance. Also similar to the ESA Regulatory Changes, compliance with the

ESA ensures the protection of ESA-listed species and designated critical habitat, including floodplains that support such species and habitat.

While adoption of the ESA-related performance standard could encourage communities to take a more active role in ensuring floodplain development is ESA-compliant, it would not change the basic structure of the NFIP or increase FEMA's influence in implementing the NFIP. FEMA's current role in floodplain management is to set performance standards and offer guidance on how to implement those standards. Applying enhanced ESA documentation requirements could strengthen ESA compliance by requiring project proponents to identify and assess adverse impacts to ESA-listed species and designated critical habitats, and for those projects with potential adverse effects on ESA-listed species and their habitat, to produce documentation of ESA compliance. This requirement could indirectly influence and encourage communities to improve implementation of the NFIP that could reduce flood risk; improve floodplain function; protect aquatic ecosystems; protect surface water and groundwater quality; and protect hydrologic characteristics, such as floodplain function while also furthering the purposes of the ESA by conserving ESA-listed species and their habitat.

Because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to reasonably ascertain whether this change would increase the levels of ESA compliance in NFIP participating communities. FEMA can ascertain that to the extent that there are significant levels of non-compliance with the ESA in those communities, this change would increase levels of compliance. Furthermore, if ESA compliance is increased by this change, FEMA expects that there would be indirect benefits to ESA-listed species, designated critical habitat, and floodplain functions. Floodplains that occupy the same habitat as ESA-listed species or provide habitat to ESA-listed species (such as non-listed flora and fauna, migratory birds, and wetlands) would be expected to benefit from mitigation actions and/or habitat conservation plans that may be established to ensure that private floodplain development is ESA-compliant. Restoring essential habitat through mitigation (e.g., wetland restoration, floodplain reconnection) would benefit terrestrial and aquatic species by re-establishing the natural vegetative cover and soil profile(s) and improving floodplain functions, including reducing surface runoff, decreasing nutrient pollution, and reducing peak flood levels (The Nature Conservancy, 2014a) (The Nature Conservancy, 2014b) (NOAA, 2016). Floodplain wetlands play a critical role in the life cycle of many riverine fishes, and "as such, the practice of floodplain wetland restoration has great potential for improving habitats for aquatic species and the survival of declining species" (Knight & Boyer, 2007). Thus, implementation of the ESA Guidance under Alternative 4 could indirectly lead to beneficial impact to water resources in some cases, and its effects on water resources, including aquatic ecosystems, surface water and groundwater quality, and hydrologic characteristics such as floodplain function, would be less than significant and beneficial.

4.3.4 Biological Resources

4.3.4.1 Significance Criteria

An evaluation of impacts to biological resources involves a comparison of current and future proposed conditions and a projection of the extent to which the alternatives might alter the current flora and fauna, migratory birds, threatened and endangered species and designated critical habitat, Essential Fish Habitat

(EFH), and wetlands. An alternative would result in adverse impacts on biological resources if it does one or more of the following:

- Causes jeopardy for any listed or candidate species or adverse modification to critical habitat under the ESA or on an equivalent State level list;
- Conflicts with existing Federal natural resource laws and regulations listed in Section 3.7;
- Substantially reduces the presence of wetlands, riparian habitat or other sensitive natural community identified in local/regional plans, in policies/regulations, or by State fish and wildlife agencies or the USFWS;
- Substantially alters the suitability or connectivity of floral/faunal habitats, including sensitive natural areas or other biologically important areas (e.g., old growth forests, stopover/resting areas and flyways for migratory birds, fish migration pathways, habitat for threatened and endangered species, EFH, and wetlands); or
- Has a substantial effect on the functions of natural communities including aquatic and marine ecosystems.

Impacts to threatened, endangered, and proposed species listed under the ESA are described in specific terms by the USFWS and the National Oceanic and Atmospheric Administration (NOAA) Fisheries (USFWS & NOAA Fisheries, 1998). For listed species or designated critical habitat, the possible effects determinations are:

- *No Effect*: If the alternative will not affect listed species or designated critical habitat;
- *Not Likely to Adversely Affect (NLAA)*: If effects on listed species or designated critical habitat are expected to be discountable, insignificant, or completely beneficial; or
- *Likely to Adversely Affect (LAA)*: If any adverse effect to a listed species or designated critical habitat may occur as a direct or indirect result of the alternative, or an interrelated or interdependent action, and the effect is not discountable, insignificant, or beneficial.

Table 4-16 provides a summary of the potential biological resources impacts.

Table 4-16: Potential Biological Resources Impact Summary

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Causes jeopardy for ESA listed or other special status species	No effect	No effect	Less than significant beneficial	Less than significant beneficial
Conflicts with existing Federal natural resource laws and regulations listed in Section 3.7	No effect	No effect	No effect	No effect
Consistency with existing Federal natural resource regulations	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial

Impact Criteria	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Substantially reduce the presence of wetlands and riparian areas and other sensitive natural communities	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial
Substantially reduces or eliminates the suitability or eliminates the connectivity of floral/faunal habitats	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial
Alter functions of natural communities	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial

4.3.4.2 Alternative 1 (No Action Alternative)

The following assessment of the No Action Alternative addresses each of the significance criteria, highlighting the aspects of the current implementation of the NFIP that are most relevant to each of the criteria. FEMA used this approach because the NFIP has many aspects, only some of which are relevant to biological resources and appropriately addressed by application of the biological resources criteria. The action alternatives, in contrast, each include a limited number of components, so it is more appropriate to organize those evaluations by the components of the alternatives.

Under the No Action Alternative, FEMA would continue the policies and program elements of the existing NFIP. The NFIP makes Federal flood insurance available to property owners or lessees in communities that participate in the NFIP. Through the NFIP, property owners in participating communities are able to insure their property against future flood losses. Through its Flood Hazard Mapping Program, FEMA identifies flood hazards, assesses flood risks, and collaborates with States and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Congress requires FEMA to identify flood-prone areas and subdivide them into flood risk zones to provide the data that is used to administer community floodplain management regulations and rate flood insurance policies.

FEMA also sets certain nationally applicable minimum floodplain management criteria to reduce flood hazard risk in floodplain areas for all NFIP participating communities. To participate in the NFIP, a community must adopt and enforce floodplain management regulations that incorporate the NFIP minimum floodplain management criteria. Under FEMA's regulations, participating NFIP communities are required to apply the minimum floodplain management criteria to all new development in the SFHA, including any buildings that are substantially damaged or improved.

FEMA has no land use authority. The power to regulate development in the floodplain, including requiring and approving permits and citing violations, requires land use authority. The regulation of land use falls under each State's police powers, which the Constitution reserves to the States, and the States delegate this power down to their respective political subdivisions. Therefore, development in the floodplain is regulated at the community level through the community's floodplain management regulations and permitting process. Before a property owner can undertake any development in the SFHA, they must obtain a permit from the community. The community is responsible for issuing and denying permits, and for reviewing the proposed development to ensure compliance with their floodplain management ordinances and that all necessary permits have been received from Federal or State agencies from which approval is required. Likewise, each community monitors compliance and enforcement of individual permits.

The NFIP was designed so that floodplain management would be carried out at the State and local levels, where land use authority resides. FEMA's *State Roles and Responsibilities in the National Flood Insurance Program* publication states that "State agency activity is important for the NFIP to function efficiently and effectively." FEMA does not directly manage State and local NFIP participation responsibilities for the more than 20,000 participating communities (ASFPM, 2010). Section 60.3(a)(2) of the NFIP requires that Floodplain Management Administrators review proposed development to assure that all necessary permits have been received from the governmental agencies from which approval is required by Federal or State law. This would include permits required pursuant to the ESA and CWA, among other laws and regulations that are pertinent to biological resources.

4.3.4.2.1 ESA-Listed Species Designated Critical Habitat

FEMA does not authorize, fund, or carry out floodplain development. Therefore, any potential effects of the Proposed Action would necessarily be indirect. As explained in FEMA's NFIP Biological Evaluation (Appendix C), floodplain development itself is not an action under the NFIP, and FEMA does not control the rate or quantity of development in floodplains or the effects those development activities may have on ESA species, designated critical habitats, or EFH. The ESA-implementing regulations define indirect effects as those that are "caused by the Proposed Action and are later in time, but are still reasonably certain to occur" (50 C.F.R. § 402.02). The NFIP does not cause development to occur, nor does it facilitate or encourage floodplain development. As such, the No Action Alternative would have no effect on ESA-listed or other special status species and designated critical habitat, and NFIP actions would have no effect on a jeopardy decision under the ESA.

In making the No Effect determination in its NFIP Biological Evaluation, FEMA acknowledges that there are a few court opinions with language stating that actions taken pursuant to the NFIP may have an effect on ESA-listed species and critical habitat and, as such, FEMA should consult on those actions.[36] However, those statements were made concerning the program as it existed at that time, and the program as it exists today is quite different from the program as it existed over a decade ago. Moreover, in those cases, the courts only had the benefit of Plaintiffs' cherry-picked documents in rendering its decisions. The vast majority of those documents were nothing more than unsupported statements and conclusory assertions. At that time, FEMA had not undertaken the rigorous analysis of the effects of the NFIP that it has now undertaken and documented in the NFIP Biological Evaluation (Appendix C). This analysis, and the data, studies, and research backing this analysis, support FEMA's conclusion that the implementation of the NFIP has no effect on ESA-listed species and critical habitat. As such, FEMA does not believe the holdings in these lawsuits represent an obstacle to its determination that the implementation of the NFIP has "no effect" on ESA-listed species and critical habitat.

[36] As an initial matter, FEMA notes that these court opinions are only binding in the jurisdictions in which they are issued; they do not bind the NFIP with respect to its compliance with the ESA at the national level.

FEMA also acknowledges that in three of the five consultations undertaken on the NFIP, the Services found that implementation of the NFIP in a specific area jeopardizes the continued survival of ESA-listed species and adversely modifies critical habitat.

Nevertheless, all of the past Biological Opinions on the implementation of the NFIP are based on the fundamental misconception that private floodplain development is attributable to, or caused (directly or indirectly) by FEMA through the implementation of the NFIP and, as such, should be treated as Federal actions subject to Section 7 consultation requirements under the ESA. The NFIP does not authorize, fund, undertake, or encourage private floodplain development (with the exception of certain grant programs), nor does it encourage such private floodplain development to occur. As such, it has no responsibilities under Section 7 of the ESA with respect to such private development.

The Biological Opinions have attempted to avoid this jurisdictional limitation of the ESA, and to federalize private floodplain development for the purposes of applying the ESA to such development, by stating that the NFIP essentially causes floodplain development by incentivizing or facilitating it. However, the evidence offered in support of this conclusion is weak and contradicted by the available data, studies, and researched cited in FEMA's NFIP Biological Evaluation (Appendix C) and Chapter 4 of this NPEIS. As such, FEMA does not feel that the conclusions reached in these Biological Opinions present an obstacle to its "no effect" determination for the NFIP.

4.3.4.2.2 Other Biological Resources

Because the NFIP only establishes a framework for management of floodplains on a community level and does not authorize, fund, or carry out floodplain development, but requires compliance thereof with applicable Federal and State laws, any effects of the NFIP on biological resources would also necessarily be indirect. When floodplains are preserved in their natural state, they provide many benefits that range from providing habitat for fish and wildlife to minimizing non-point source water pollution that could adversely impact such habitat and the species that inhabit it (ASFPM, 2008). As described in Section 4.1.1 the NFIP neither causes development to occur, nor is a driver in facilitating or encouraging floodplain development. As such, floodplain development and any resulting diminishing of the functions of natural communities is not a direct effect of the implementation of the NFIP.

Although FEMA does not have the land use authority to restrict development in floodplains, the minimum floodplain management criteria (44 C.F.R. § 60.3) include certain limitations to how such development is carried out that benefit biological resources. To the extent that the FEMA requirement in 44 C.F.R. § 60.3 provides floodplain management regulations increases compliance with the CWA, this requirement could benefit biological resources by providing protections for habitat, including surface and groundwater quality, floodplain functions, and aquatic ecosystems, because the CWA was promulgated to protect these resources. The minimum criteria include a requirement that, subject to limited exceptions where appropriate analysis has been conducted, encroachment in riverine floodways may not cause an increase in flood heights. This requirement may also help protect biological resources within the floodplain by providing habitat protection during storm events, preventing degradation of surface and groundwater quality, and protecting aquatic ecosystems. It was estimated that approximately 9,000 square miles of floodways have been protected by this requirement (AIR - Wetmore et al., 2006). Additionally, per 44 C.F.R. §§ 60.3(e)(3) and (e)(6), communities cannot locate new construction seaward of mean high tide (e.g., construction cannot occur over water) or place fill within coastal velocity zones (V Zones), providing further protections to coastal ecosystems. Zones V1-30, VE, and/or V identified on FIRMs are considered coastal high hazard areas and subject to tidal surges, wave action, and high winds from storms and hurricanes. These minimum criteria requirements may help protect against high water levels, erosion, and scour, which can undercut building foundations and cause degradation of water quality and impacts to aquatic ecosystems. Mangroves and sand dunes are also addressed under FEMA's minimum floodplain management criteria. Before these areas may be altered, the community or project proponent must undertake an analysis to demonstrate that the proposed development activities would not increase potential flood damage. By limiting encroachment in mangroves and sand dunes, these natural features continue to protect the shoreline from coastal storms, reduce flood damage to communities, and benefit surface and groundwater quality and aquatic ecosystems.

However, there are also certain aspects of the NFIP program, such as the NFIP floodplain management program, including the CRS, and mapping activities that guide development away from flood hazard areas. Although FEMA does not have the land use authority to restrict development in floodplains, the minimum floodplain management criteria include certain performance standard regarding how such development is carried out that benefit biological resources. For example, the minimum floodplain management criteria require that floodplain development may not cause an increase in flood heights. Studies have also found that NFIP performance standards require participating communities to only allow encroachment in its riverine floodway that would not cause an increase in flood heights (subject to certain regulatory exceptions) (44 C.F.R. § 60.3d and e), have prevented a great deal of development in coastal floodplains and mapped floodways (AIR - Wetmore et al., 2006). Additionally, FEMA's minimum floodplain management criteria at 44 C.F.R. § 60.3(a)(2) requires communities to, for all permits to develop in the floodplain, "review [the] proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law." This includes any permits required under the ESA. By encouraging practices that result in less development of the floodplain, this requirement could lead to less adverse impacts to those biological resources in the floodplain that might otherwise have been adversely impacted by such development.

The CRS also plays a key role in encouraging conservation of floodplains, and therefore biological resources within those floodplains, by offering flood insurance premium discounts to residents of communities that implement voluntary mitigation activities. The CRS is a voluntary program for recognizing and encouraging (with financial incentives) community floodplain management activities that exceed the minimum NFIP standards.

The CRS provides credit for activities that can result in increased habitat protection beneficial to flora and fauna, threatened and endangered species, wetlands, and EFH. FEMA has issued *CRS Credit for Habitat Protection* guidance to describe the types of habitat protection activities that are eligible for CRS credit and, as such, flood insurance premium discounts (FEMA, 2010). FEMA gives CRS credit to communities that create a habitat conservation plan; preserve open space that serves as habitat for flora and fauna; and/or require a buffer, or area in which little or no development is allowed, along streams (FEMA, 2010). Habitat conservation plans, open space preservation, and buffer zone creation preserve habitats, including wetlands, and the connectivity between these habitats, including sensitive natural areas or other biologically important areas. This can result in a beneficial effect of its program on wetlands, riparian areas, other sensitive natural communities, floral and faunal habitat and connectivity.

The flood hazard mapping element of the NFIP, including publishing FIRMs and the administrative procedures for changing and revising them (i.e., issuing LOMCs), involves using the best available data to delineate SFHAs. However, publishing FIRMs may help promote broad-based awareness among affected individuals of the risks associated with living in a floodplain and could help guide development away from flood hazard areas. For example, the City of San Antonio, TX recognizes the additional flood risks associated with living in a floodplain by prohibiting new residential structures in areas designated on the flood map as areas of special flood hazard (i.e., the regulatory floodplain) on FEMA flood maps. The City of San Antonio also places freeboard requirements on non-residential structures in the floodplain and any structures adjacent to the floodplain. Additionally, the City treats the entire SFHA as the floodway for regulatory purposes, which means the additional restrictions applicable in the floodway apply throughout the floodplain.

FEMA also provides best available data and, upon request from the community, future conditions maps. This information may then be used by communities to help establish future community zoning, land use, and building standards to guide development away from flood hazard areas. Since 1999, the unified government of Charlotte-Mecklenburg incorporates "build-out land-use conditions" using future land-use and population growth projections in the SFHA and in the expanded future conditions floodplain, placing additional restrictions on building and renovations in the expanded boundary. By guiding development away from flood hazard areas, the implementation of the NFIP mapping activities benefits biological resources that might otherwise be adversely impacted by development.

Based on the above analysis, and in light of the information provided in Section 4.1.1, implementation of the No Action Alternative does not conflict with existing Federal natural resource laws and regulations listed in Section 3.7, and has no effect on the ESA-listed species and designated critical habitat. Implementation of the No Action Alternative would likely have an overall indirect, less than significant beneficial effect on other biological resources through the NFIP's floodplain management and flood hazard mapping activities, and the incentives it provides for communities to conserve biological resources.

4.3.4.3 Alternative 2 (Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) (Preferred Alternative)

Under the legislatively required aspect of Alternative 2, the phasing out of subsidies on pre-FIRM properties and the implementation of a monthly installment plan for non-escrowed flood insurance policies would occur. If the legislatively required aspects of Alternative 2 were to have an effect on development decisions, it could result in indirect effects to biological resources. As described in Section 3.7.3.1, human development is considered a threat to biological resources due to factors such as incremental habitat loss and disturbance, degradation of water quality, erosion, and degradation or removal of movement and migration corridors. FEMA does not expect that the legislatively required aspects of Alternative 2 would influence development decisions and thus would not alter the landscape of wetlands, natural communities, or other floral or faunal habitat, and would not result in an appreciable effect on biological resources.

With respect to the program modification to phase out subsidies, this would apply only to pre-FIRM policyholders. As discussed in Section 1.3.3, pre-FIRM policyholders are policyholders whose residences were built prior to the community's first FIRM. Since nearly all existing NFIP communities have FIRMs, the population of potential new pre-FIRM policyholders would be limited to policyholders in the existing NFIP communities without a FIRM or policyholders in communities that join the NFIP in the future. However, the likelihood of a project proponent making a decision about whether or not to develop in the floodplain based on potentially applicable subsidy phase-outs should a community be mapped and/or join the NFIP is remote and speculative and thus is not considered in a discussion of the impacts of this alternative.

With respect to the program modification to allow non-escrowed policyholders to pay for their flood insurance in monthly installments, FEMA intends to add a monthly service fee to installment plan policies, such that these policies would actually be more expensive than annual policies. This would serve to discourage their widespread use by anyone other than policyholders currently in a high flood risk area (but not subject to mandatory purchase since those premiums would be escrowed) for whom flood insurance is otherwise not affordable. It is unlikely that a policyholder with the affordability issues that would necessitate utilization of an installment plan would have the disposable income necessary to finance new development, for any reason much less for the purpose of taking advantage of this new payment option. More importantly, because this change is solely a change to the insurance payment options of individuals, and not a change that influences how development is carried out or other activities that could impact biological resources, this change would have no impact on biological resources.

Under the floodplain management criteria aspect of Alternative 2, FEMA would clarify that pursuant to 44 C.F.R. § 60.3(a)(2), a community must obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain. Because the proposed clarification to the minimum floodplain management criteria does not change the existing legal compliance requirements associated with permits to develop in the floodplain, but merely documents that such compliance is occurring, the change will have no impacts on biological resources, including ESA-listed and special status species and critical habitat, beyond those associated with implementation of the No Action Alternative.

Under the LOMC clarification portion of Alternative 2, FEMA's issuance of certain LOMC requests (i.e., map revisions) would be contingent on the community, or the project proponent on the community's behalf, submitting documentation of compliance with the ESA. It is notable that the private floodplain development for which a map change request is sought has already taken place. Therefore, any legal compliance activities related to such development would have taken place before FEMA's involvement. Because the ESA documentation in question should have already been procured at the permitting stage for development in the floodplain and the floodplain development for which a map change request is sought would have already occurred before the LOMC was requested, this clarification would have no effect on biological resources. Moreover, because such development is already subject to the requirements of 44 C.F.R. § 60.3(a)(2), including the requirement that floodplain development must comply with all applicable Federal and State laws before a permit to develop in the floodplain may be issued, and because the floodplain development for which a map change request is made has already taken place, implementation of the Alternative 2 has no impacts on biological resources including ESA listed and special status species and designated critical habitat, and would not conflict with existing natural resources laws or policies.

4.3.4.4 Alternative 3 (Legislatively Required Changes, Proposed ESA Regulatory Changes, and LOMC Clarification)

The impacts for the legislatively required and LOMC clarification portions of this alternative would be the same as those described in Alternative 2 (Section 4.3.4.3). The impacts associated with the ESA Regulatory Changes portion of Alternative 3 are described below. The ESA Regulatory Changes refer to the ESA-related performance standard, the clarification to the exception to the no rise standard in the floodway, and the increase in the probation surcharge.

The ESA-related performance standard, which is part of the ESA Regulatory Changes, would be structured as a mandatory performance standard that would require NFIP participating communities to obtain and maintain documentation that adverse impacts to ESA-listed species and designated critical habitat, including the natural and beneficial functions of floodplains that support such species and habitat, have been assessed and mitigated to the greatest extent possible. While adoption of the ESA-related performance standard would not change the basic structure of the NFIP or increase FEMA's land use authority or influence in implementing the NFIP, it could encourage communities to take a more active role in ensuring floodplain development is ESA-compliant.

FEMA would develop guidelines and/or a process for documenting community compliance with the ESA Regulatory Changes. Communities would be monitored for compliance with the new ESA-related performance standard, and FEMA would take enforcement actions against communities that did not adhere to it (through existing processes such as CAVs and CACs). This change would increase a community's stake in ESA compliance and provide a means for FEMA to more effectively monitor communities' review and mitigation of the potential impacts of development on ESA-listed species and designated critical habitats. This increased stake may encourage communities to become more aware of ESA-related issues in their community and potentially develop holistic approaches to address such issues rather than continuing to address them on a permit-by-permit basis. It may also encourage communities to work more closely with the Services to develop tools to help identify areas with ESA-listed species and designated critical habitat and to establish mitigation measures specific to the community and/or the ESA-listed species found in the community. Such actions may improve a community's ability to assess and address the cumulative impacts of floodplain development on ESA-listed species and designated critical habitat. All this would, in turn, improve FEMA's ability to demonstrate the beneficial effect of its program on wetlands, riparian areas, and other sensitive natural communities; floral and faunal habitat; and other associated biological resources.

Because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to reasonably ascertain whether the change would increase the levels of ESA compliance in NFIP participating communities. FEMA can ascertain that if there are significant levels of non-compliance with the ESA in those communities, the change would increase levels of ESA compliance. Furthermore, if ESA compliance is increased by the change, FEMA expects that there would be indirect benefits to ESA-listed species and designated critical habitat. Biological resources that occupy the same habitat as an ESA-listed species or provide habitat to ESA-listed species (such as other flora and fauna, migratory birds, and wetlands) would also be expected to benefit from any mitigation actions and/or habitat conservation plans that may be established to ensure that private floodplain development is ESA-compliant. Moreover, in addition to ensuring compliance with the ESA, the ESA-related performance standard would require communities to ensure that impacts to habitat connectivity and the natural and beneficial floodplain functions that support such species and habitat are also assessed and mitigated, which would benefit all biological resources in those floodplains, not just ESA-listed species and designated critical habitat.

Under the ESA Regulatory Changes, current NFIP regulations would also be clarified to expressly state that the current exception to the no-rise performance standard would apply only to projects serving a public purpose or that result in the restoration of the natural and beneficial functions of floodplains. According to FEMA's estimates, clarifications made pursuant to this alternative would result in approximately 15 fewer development projects being located in floodways per year than are currently located there now. Even though this change would serve to slightly limit the types of floodplain development that may cause a rise in the floodway, any beneficial effects to biological resources that would be expected from such limits (see discussion in Section 3.7.3.1 on adverse effects of human development) would at most be negligible because the regulation clarification would only affect about 15 projects per year across the nation.

Additionally, pursuant to the ESA Regulatory Changes, the probation surcharge applicable to NFIP communities placed on probation would be increased from $50 to $100. A NFIP-participating community may be placed on probation if FEMA determines that a community is not making adequate progress towards correcting issues of non-compliance, including non-compliance issues under the ESA, even after technical assistance has been provided. Under the change, when a community is placed on probation, a $100 surcharge would be added to the flood insurance policies of all policyholders in that community. This would be a $50 increase in the probation surcharge. Such a program modification could encourage non-compliant communities, including communities non-compliant with the ESA Regulatory Changes (or the ESA, under the requirements of 44 C.F.R. § 60.3(a)(2)), to come into compliance and avoid the increased probation surcharge. This could have indirect beneficial impacts on ESA-listed species, designated critical habitat, and associated biological resources.

Based on the above analysis, implementation of the Alternative 3 would likely have an overall indirect, less than significant beneficial effect on biological resources.

4.3.4.5 Alternative 4 (Legislatively Required Changes, ESA Guidance, and LOMC Clarification)

The impacts for the legislatively required and LOMC clarification portions of this alternative would be the same as those described in Alternative 2 (Section 4.3.4.3). The impacts associated with the ESA Guidance portion of Alternative 4 are described below.

Under Alternative 4, incorporation of specific ESA Guidance would provide a number of benefits. First, it would help further, and support the purposes of, the ESA and NFIA for floodplain management within the confines of FEMA's legal authority. Incorporating the ESA Guidance would more directly address the steps that communities should take regarding floodplain development; specifically, communities would have to identify whether ESA-listed species or designated critical habitat are present in the Action Area, and assess whether the proposed development would adversely impact ESA-listed species and designated critical habitat. The institution of this process, combined with documentation and record keeping guidance, would improve documentation of ESA compliance and aid FEMA in better demonstrating that FEMA is implementing the NFIP in an ESA-compliant manner.

Unlike the ESA Regulatory Changes, the ESA Guidance would not develop any new guidance on the mitigation of adverse impacts that were documented and reported unless the Services identified a need for it. However, communities could use the existing Habitat Conservation Plan guidance, developed by the Services and pursuant to Section 10 of the ESA, when developing mitigation plans. Monitoring and enforcement in communities would be through existing processes such as CAVs and CACs, and would ensure that the guidance was being followed and documentation of ESA compliance was being obtained and maintained by the communities. Like the ESA-related performance standard, this would give communities a larger stake in ensuring floodplain development is ESA-compliant, and would have guidelines and/or a process for documenting community compliance. Also, similar to the ESA Regulatory Changes, through monitoring and enforcement, communities could be more aware of ESA-related issues in their community and potentially develop holistic approaches to address such issues. It may also encourage communities to work more closely with the Services to develop tools to help identify areas with ESA-listed species and designated critical habitat and to establish mitigation measures specific to the community and/or the ESA-listed species found in the community. Such actions may improve a community's ability to assess and address the cumulative impacts of floodplain development on ESA-listed species and designated critical habitat. All this would, in turn, improve FEMA's ability to demonstrate the beneficial effect of its program on ESA-listed species, designated critical habitat, and other associated biological resources.

Because the Services have never undertaken any formal review of the level of compliance with Sections 9 and 10 of the ESA, FEMA is unable to reasonably ascertain whether this change would increase the levels of ESA compliance in NFIP participating communities. FEMA can ascertain that to the extent that there are significant levels of non-compliance with the ESA in those communities, this change would increase levels of compliance. Furthermore, if ESA compliance is increased by this change, FEMA expects that there would be indirect benefits to ESA-listed species and designated critical habitat. Biological resources that occupy the same habitat as ESA-listed species or provide habitat to ESA-listed species (such as non-listed flora and fauna, migratory birds, and wetlands) would also be expected to benefit from any mitigation actions and/or habitat conservation plans that may be established to ensure that private floodplain development is ESA-compliant. Based on the above analysis, implementation of Alternative 4 would likely have an overall indirect, less than significant beneficial effect on ESA-listed species, designated critical habitat, and associated biological resources through the incorporation of specific ESA Guidance.

4.4 COMPARISON OF ENVIRONMENTAL EFFECTS OF ALTERNATIVES

4.4.1 Summary of Alternatives Analysis

Table 4-17 includes a summary of the potential environmental impacts associated with selection of the Alternatives evaluated in this NPEIS.

Table 4-17: Summary of Alternatives Analysis

Attribute	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	Alternative 4
Meets Purpose and Need	No	Yes	Yes	Yes
Air Quality	No impact	No impact	No impact	No impact
Noise	No impact	No impact	No impact	No impact
Geology and Soils	No impact	No impact	No impact	No impact
Aesthetics/Visual Resources	No impact	No impact	No impact	No impact
Hazardous Wastes and Materials	No impact	No impact	No impact	No impact
Climate Change	No impact	No impact	No impact	No impact
Historic and Cultural Resources	No impact	No impact	No impact	No impact
Infrastructure	No impact	No impact	No impact	No impact
Socioeconomic Resources	Less than significant	Less than significant	Less than significant	Less than significant
Land Use	Less than significant	No impact	Less than significant beneficial	Less than significant beneficial
Water Resources	Less than significant beneficial	No impact	Less than significant beneficial	Less than significant beneficial
Biological Resources	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial	Less than significant beneficial

4.5 CUMULATIVE IMPACT ASSESSMENT

In accordance with NEPA (42 U.S.C. § 4321 et seq.), this Final NPEIS considers the overall cumulative impact of the proposed alternatives and other actions that are related in terms of time or proximity. According to CEQ regulations (40 C.F.R. §§ 1500-1508), cumulative impacts represent the "impact on the environment which results from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 C.F.R. § 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period (40 C.F.R. § 1508.7). If the alternative does not have direct or indirect effects for a particular resource, there can be no cumulative effects resulting from the project because there would be no impacts to add to past, present, or reasonably foreseeable actions.

The cumulative impact analysis for this Final NPEIS evaluates the potential impacts associated with the Preferred Alternative (Alternative 2, Legislatively Required Changes, Floodplain Management Criteria Guidance, and LOMC Clarification) in combination with other relevant past, present, or future projects that could affect the Action Area. Section 4.1 identifies the changes included under the Preferred Alternative (Alternative 2). Section 4.5.1 presents the methodology used to evaluate cumulative impacts. Section 4.5.2 discusses other actions that may have cumulative effects when combined with the potential impacts from the proposed NFIP Program. Section 4.5.3 identifies and describes the potential cumulative impacts. Section 4.5.4 describes the irreversible and irretrievable commitment of resources. Section 4.5.5 identifies the unavoidable adverse impacts. Section 4.5.6 describes the relationship between short-term and long-term productivity.

4.5.1 Cumulative Impacts Methodology

This methodology identifies the approach and assumptions for assessing cumulative effects, following the principles outlined by the CEQ in its report, *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ, 1997b). NEPA requires the consideration of past, present, and reasonably foreseeable future projects as part of the cumulative effects impact analysis for this Final NPEIS. Projects included in the cumulative analysis were identified through the review of: (1) recent environmental NEPA documentation (Federal projects and federally funded State projects); (2) various State planning documents (e.g., State Implementation Plans, Comprehensive Zoning Map Processes); (3) comments received during the previous public scoping periods; and (4) internet research, as shown in Table 4-18. The projects included in Table 4-19 could impact some aspect of the natural or human environment when considered in conjunction with the Preferred Alternative. Even though some projects may not individually result in impacts to the environment, when combined with the Preferred Alternative or other Federal, State, or local projects occurring nearby and within the same period, the environmental impacts may become significant.

CEQ guidance directs that the cumulative impact analysis should focus on important issues of national, regional, or local significance. Because of the wide geographic scope of this impact assessment and the variety of activities assessed, cumulative impacts are examined at a qualitative and less detailed level than the direct and indirect impacts. Unforeseen changes in factors such as economics; public demand; and Federal, State, and local laws and policies could result in different outcomes than those projected for this analysis.

Cumulative effects occurring in floodplains could include the indirect effects of the Proposed Action, combined with private floodplain development activities across the nation initiated by State agencies or local jurisdictions, Tribal entities, or private landowners. Activities could range from residential and business development to expansion and construction of new infrastructure, such as buildings, roads, utilities, or water-related projects (e.g., irrigation withdrawals, bank protection, and general land clearing). These factors may inevitably affect surface waters and terrestrial and aquatic habitats.

Table 4-18: Data Sources for the Evaluation of Cumulative Effects

Required Data	Data Source	Data Application
Past and future trends	Readily-available information from Federal documentation and websites (e.g., United States Environmental Protection Agency [EPA] website on trends in water quality, public comments)	Understanding of past trends that have resulted in the current condition of the resource and the potential for a resource's condition to improve or decline in the future
Reasonably foreseeable future actions (floodplain related)	No Action Alternative project list	Relevant floodplain related projects approved for future implementation
	Environmental (NEPA) documentation for reasonably foreseeable future actions (floodplain related)	Summary of potential environmental effects that may occur as a result of reasonably foreseeable future actions (floodplain related)
Reasonably foreseeable future actions (non-floodplain related)	Interviews with Federal and State regulatory and resource agencies	Large-scale future actions related to residential or commercial development or natural resource development activity
	Environmental documentation for reasonably foreseeable future actions (non-floodplain related)	Summary of potential environmental effects that may occur as a result of reasonably foreseeable future actions (non-floodplain related)

4.5.2 Past, Present, and Reasonably Foreseeable Future Projects

For the purposes of this NPEIS, reasonably foreseeable future actions are those projects in SFHAs nationwide likely to occur. Because there are more than 22,000 NFIP-participating communities within the Action Area (FEMA, 2016a), these future effects would be difficult to reasonably quantify, and the number of projects could be innumerable. Across the nation, there are a number of State, local, and Tribal efforts to reduce and minimize ongoing cumulative effects to ESA species, provide greater protection to historic and cultural resources, identify and consider Environmental Justice communities, and apply increasingly stringent water-related regulations.

Direct cumulative impacts could occur from any development activity initiated or permitted by State or local jurisdictions, tribes, or private landowners outside the purview of the NFIP. Potential activities range from residential and business development; expanding and building new infrastructure such as buildings, roads, utilities; water-related projects such as flood control, water storage, or hydroelectric projects; continued irrigation withdrawals; bank protection; and general land clearing.

Table 4-19 provides the project name and agency sponsor, a brief project description, resource area that may be affected, and agencies that may permit these associated activities, based upon readily available information.

Table 4-19: Examples of Past, Present, and Reasonably Foreseeable Future Projects

Project Name	Project Sponsor	Resource Area Most Likely Affected	Example Agencies[a] that Could Permit These Activities
Privatization of flood insurance (private	Private insurance companies	Socioeconomic Resources	Not applicable

Project Name	Project Sponsor	Resource Area Most Likely Affected	Example Agencies[a] that Could Permit These Activities
companies), varies throughout the nation			
Federal Floodplain Development	Agencies that undertake development activities, such as construction and restoration,	Land Use and Planning, Water Resources, Biological Resources, Historic and Cultural Resources, Infrastructure, Historic and Cultural Resources	USACE, Department of Defense (DoD), General Services Administration (GSA)
Federal Floodplain Development	Agencies that fund activities that result in construction or development in floodplains.	Land Use and Planning, Water Resources, Biological Resources, Historic and Cultural Resources, Infrastructure, Historic and Cultural Resources	United States Department of Agriculture (USDA), Housing and Urban Development (HUD), Department of Transportation (DOT)
Federal Floodplain Development	Agencies that authorize development activities.	Land Use and Planning, Water Resources, Biological Resources, Infrastructure, Historic and Cultural Resources	USACE, USDA, Bureau of Land Management (BLM), National Park Service (NPS), United States Forest Service (USFS)
Private Floodplain Development	Project Proponents, Developers, Communities, etc.	Water Resources, Biological Resources, Historic and Cultural Resources, Socioeconomic Resources	Not applicable

[a]This is not a comprehensive list; list of agencies provided as examples only.

4.5.2.1 Project Descriptions

Privatization of Flood Insurance. Insurance is one of the key economic mechanisms used for risk management, enabling risk-taking behavior and providing financial security for investors, developers, and private citizens (Krieger, 2015). Until recently, one major obstacle for private market insurers entering the flood insurance market has been the lack of ability of private carriers to compete with subsidized premiums that are offered by the NFIP for certain properties (i.e., pre-FIRM buildings) (Insurance Journal, 2014). While private insurers have the capacity to provide coverage for flooding risk and can price more accurately using better modeling tools, the lower premium rates offered by the NFIP for certain policies have hindered their entrance into the market.

However, industry experts and reports have found that private insurers may be willing to write significant amounts of flood business if they are allowed to charge actuarially sound rates (Insurance Journal, 2014). According to the Fitch Ratings Report, if and when Federal subsidies for flood insurance are reduced and the cost of government provided flood insurance goes up, the demand for private flood coverage is projected to rise (Insurance Journal, 2014).

Following BW-12, HFIAA, and initiation of the phase out of flood insurance subsidies for pre-FIRM properties, several private insurance companies are beginning to offer private flood insurance at competitive rates. With the introduction of private flood insurance into the Government dominated market, flood insurance rates are expected to become competitive and result in better policies and pricing for homeowners. Private flood insurance is available from 13 vendors within Pennsylvania (Pennsylvania Insurance Department, 2016) and Florida (Florida Office of Insurance Regulation, 2016). The Flood Insurance Agency (TFIA) offers flood insurance policies in 33 States, and Lloyd's of London offers policies in 37 States. The TFIA predicted an expansion from $500M in insured property to $1B by the end of 2014 (Hurtibise, 2014). Other insurance companies offering private flood insurance policies are Homeowners Choice Property & Casualty Insurance, who has just expanded their coverage area to include Florida; Gridiron Insurance Underwriters; and Chubb Personal Flood Insurance. A number of private insurance providers also provide flood coverage that exceeds the maximum allowable limits statutorily authorized for the NFIP ($250,000 for structural damage and $100,000 for contents for residential properties, as well as $500,000 each for structure and contents for non-residential properties) (Insurance Journal, 2014).

Even for non-subsidized policies (i.e., policies on post-FIRM buildings), premium rates are also increasing substantially from the recent legislative changes. Because of BW-12, FEMA is required to establish a Reserve Fund for meeting the expected future obligations of the flood insurance program. FEMA funds this account through a Reserve Fund Assessment added to the premium on NFIP policies. The Reserve Fund Assessment was introduced in October 2013 as a 5 percent assessment on all policies, and there is now a 15 percent assessment on all policies. That percentage is expected to increase until the annual collections from that Assessment reaches the statutory minimum amount, which at the time it was introduced was about $1B annually. Additionally, because of HFIAA, all policyholders have to pay a surcharge of $25 for policies on a primary residence and $250 on all other policies. As such, even for non-subsidized policies, the market has grown significantly more competitive.

Private market participation has already increased significantly and will likely continue to do so as the NFIP moves further towards actuarial rates. To the extent that the availability of flood insurance has an influence on floodplain development, the private market will increase its influence in that respect. More to the point, as the market for private flood insurance grows, any influence on the availability of NFIP flood insurance, in particular, may have on floodplain development would diminish since even without participating in the NFIP, a community would still have access to flood insurance at the same price, without the additional burden of compliance with the minimum floodplain management regulations and government-imposed assessments, fees, and surcharges.

Federal Floodplain Development−Federal Agencies that Carry Out Development. Agencies such as USACE, DOD, and GSA carry out development activities. Examples of such activities include the construction and restoration of levees and other flood control projects, installations and military bases, and the construction of Federal facilities.

Federal Floodplain Development−Federal Agencies that Fund Activities. Agencies such as USDA, HUD, and DOT fund activities that result in construction or development in floodplains. Examples of activities include housing, highway and bridge construction, and post-disaster reconstruction.

Federal Floodplain Development−Federal Agencies that Authorize Activities. Agencies such as USACE, USDA (including USFS), and Department of Interior (NPS and BLM) authorize development activities. Examples of authorized activities include construction, extraction of natural resources, and dredge and fill operations.

Private Floodplain Development. Private floodplain development includes projects that are funded by a private citizen or a commercial or residential developer. There is limited data about the trends of private floodplain developments. In the absence of such data, there is data on the total number of new privately owned housing units, the definition of which consists of houses, apartments, mobile homes or trailers, groups of rooms, or single rooms that are occupied, or, if vacant, are intended for occupancy as separate living quarters, authorized by building permits (U.S. Census Bureau, 2016d). According to the methodology presented in the FEMA *Floodplain Management Losses Avoided Study*, approximately 7.3 percent of the single-unit residential buildings in the nation are in the SFHA (FEMA, 2014). This percentage was applied to the annual number of building permits for single-unit structures to estimate the annual number of single-unit structure building permits in the SFHA.

Table 4-20 shows the results in the total number of privately owned single-unit residences authorized in the United States and the estimated number of such units authorized in the SFHA. Table 4-20 shows that the total number of new privately owned single-unit residential building permits authorized has increased nationwide from approximately 518,695 units in 2012 to 695,998 units in 2015. Similarly, the number of such units authorized in the SFHA has increased from 38,208 units in 2012 to 50,750 units in 2015.

Table 4-20: New Privately Owned Housing Units Authorized

Year	Total Number of Authorizations for One Unit Structures	In SFHA
2012	518,695	38,208
2013	620,802	45,591
2014	640,318	46,858
2015	695,998	50,750

Notes: A housing unit, as defined for purposes of these data, is a house, an apartment, a group of rooms, or a single room intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants live separately from any other individuals in the building and which have a direct access from the outside of the building or through a common hall.
Source: (U.S. Census Bureau, 2016d)

4.5.2.2 Existing Conditions and Trends of Resource Areas with Potential Impacts

Key resources are those resources that have the greatest potential to be affected by the alternatives thereby likely having the greatest potential to be affected by cumulative effects from other projects as well. Table 4-21 presents the key resource areas and a summary of the existing conditions and trends for each.

Table 4-21: Existing Conditions and Trends of Resource Areas with Potential Impacts

Resource Area	Existing Conditions	Trends
Socioeconomic Resources	Between 2000 and 2015, the United States population increased by 14%.	With an ever changing economy, development can increase or decrease in an area depending on multiple economic and social drivers.
Land Use and Planning	Undeveloped land cover is generally concentrated in rural and natural locations outside the metropolitan areas and within waterbodies.	Between 1980 and 2000, the amount of developed land in the United States has increased by 34%. Forests, in particular, have been the largest source of land converted to developed uses in recent decades, with resulting impacts on forest cover and other ecological attributes (Alig, Kline, & Lichtenstein, 2003).
Water Resources	Metropolitan areas are built on and around major waterbodies such as oceans and large rivers. Agricultural drainage and stormwater runoff introduce contaminants resulting in a wide range of effects that accumulate in the food chain. Water pollution can alter water quality in ways that are often detrimental to species affecting temperature, pH, sedimentation, visibility, hardness, dissolved oxygen, salinity, and nutrient availability. Domestic and industrial facilities, although regulated through a permit process, may exceed the permitted limits or otherwise discharge more than the receiving water system can accommodate. (USFWS, 2015)	The nation's population is continuing to grow, particularly near coastal floodplains, and is expected to continue growing. In 1977, the U.S. Water Resources Council estimated that about 7% of the United States (including Alaska and Hawaii) was within the 100-year floodplain, totaling nearly 279,688 square miles (Natural Hazards Research and Applications Information Center, 1992). Approximately 3% of the population lives in areas subject to the 1-percent-annual-chance coastal flood hazard. It must be emphasized, however, that these numbers are based on the 1-percent-annual-chance (100-year) coastal flood.

Resource Area	Existing Conditions	Trends
Biological Resources	As of December 2014 (when data were collected for the NFIP Biological Evaluation [Appendix C]), there were 1,537 species (649 animals and 888 plants) in the United States listed as threatened or endangered (FEMA, 2015c). EFH has been described for approximately 1,000 managed species as of 2015 (NOAA Fisheries, 2015b). These include groundfish, such as flounder; pelagic species, such as tuna and mackerel; anadromous fish, such as salmon; and shellfish, such as scallops. NOAA Fisheries and the Regional Fishery Management Councils have also identified more than 100 Habitat Areas of Particular Concern. Throughout the United States, wetland types vary widely because of regional and local differences in vegetation, soils, topography, climate, hydrology, and water chemistry. The most recently available data identify an estimated 110.1 million acres of wetlands in the United States as of 2009; about 95% of these wetlands were freshwater and 5% were marine or estuarine (saltwater) systems (Dahl, T.E., 2011).	While it is reasonably foreseeable that there will be private floodplain development in the Action Area within the next 20-30 years, the extent and the impacts of such development is not reasonably foreseeable. There are also a number of factors affecting ESA-listed species within the timeframe of the Preferred Alternative, such as economic factors, including the availability of jobs, proximity to ports, and tourism and recreation; infrastructure; and proximity to natural resources and existing communities (discussed in detail in theNFIP Biological Evaluation, Appendix C). These factors make it difficult to determine what effects to ESA-listed species are properly attributable to private floodplain development, even if the extent of such development were somehow ascertainable. Moreover, the factors themselves are difficult to quantify. The variety of unknown influencers related to protected species and habitats in the United States are challenging to quantify.

4.5.3 Cumulative Impacts within Resource Areas with the Potential for Impacts

The intensity and duration of the cumulative impacts are considered when determining the magnitude of the cumulative impacts to each resource area. Due to the nature of this project and the scope of the project, specific impacts are difficult if not impossible to quantify. As a result, FEMA prepared a qualitative analysis of cumulative impacts. For the purposes of this NPEIS, the cumulative impacts are described for the Preferred Alternative.

4.5.3.1 Socioeconomic Resources

4.5.3.1.1 Privatization of Flood Insurance

The increasing availability of private flood insurance could, over time, reduce costs of flood insurance for some property owners who purchase flood insurance and could increase the cost of flood insurance for others. As subsidized premium rates in the NFIP are phased out, private flood insurance will become more competitive and it is likely that a number of property owners will be able to obtain flood insurance at lower rates than those offered by the NFIP. Among other restrictions that the NFIP faces, there are certain costs placed on Federal insurance policies that are not placed on policies sold in the private market, including the HFIAA surcharge, the Reserve Fund Assessment, the Federal Policy Fee, and any applicable probation surcharges. However, private insurers do load their policies to be able to cover large events in a way that the NFIP currently does not, so the difference in policy price may not be as large as some anticipate.

Nevertheless, while the NFIP is required to insure any eligible property regardless of its risk and provide discounted rates to certain properties, the private flood insurance market may only open up to a subset of policies. Private insurers can and do pick and choose the properties that they insure against certain perils based on both individual and aggregate risk to diversify their portfolios and securitize risk. Thus, the availability of private insurance in some geographical areas may be much greater than in other areas, and private flood insurance may not be offered to all who want or need to purchase it.

The NFIP covers policyholders in both high and low risk areas. The low risk policies are less expensive than the high risk policies, but nevertheless help the NFIP ensure that it has enough cash on hand to pay claims up to a certain level. The required fees constitute a higher percentage of the cost of these policies than the low risk ones, and it is likely that the private sector could offer similar policies at a competitive price, eroding the NFIP's policy base. Without these policies that essentially provide a buffer for the national flood insurance fund, the NFIP's finances will be much more volatile.

Relatedly, there could be a cyclical feedback mechanism: The more low risk policies the NFIP loses, the more FEMA would have to charge for the remaining policies to cover program costs, such as flood risk assessment, and cross subsidies, such as grandfathering and the CRS. The more the NFIP charges for the remaining policies, the more competitive the private sector could be because the NFIP would offer no pricing advantages over private flood insurance.

There could be cumulative effects of the preferred alternative and private insurance on 1) flood insurance coverage within flood zones and 2) the costs of flood insurance. Some property owners who are not required to purchase flood insurance as a condition of federally backed loans may choose to switch to private insurance rather than drop flood insurance coverage due to increasing NFIP premium rates. In addition, cheaper private flood insurance may mean some property owners who currently do not have flood insurance would choose to purchase it. Therefore, based on these two factors, the total number of properties covered by flood insurance could increase over time.

Additionally, there are certain factors specific to private flood insurance industry that could cause the number of policies in the SFHA to increase. One such factor is the ability of the private flood insurance market to specialize their policies. The NFIP standard flood insurance policy is quite rigid: coverage limits are set in statute, fees are mandatory, and inclusions and exclusions of the policy are in regulation. As such, private insurers could compete with the NFIP on the basis of choice—additional coverage options or increased coverage limits may either grow the number of people covered or encourage current policyholders to switch from the NFIP to a private carrier. Even where this coverage is more expensive than current NFIP rates, private flood insurance may nonetheless appeal to consumers based on their preferences.

Another factor is the ability of the private flood insurance market to be more granular in their assessment of risk. Unlike the way the NFIP currently sets rates, the private flood insurance market can differentiate risk based on whether someone is at edge of SFHA or right next to flooding source. A private company could then choose to insure the better risk located far away from the flooding source, and could do so at a lower cost than the NFIP (i.e., because the cost would reflect that this property was actually less of a flood risk than other properties in the same class that are nearer to the flooding source).

Because the private flood insurance market would tend to accept more of the low cost, low risk policies and less of the high cost, high risk policies, the privatization of the flood insurance market is unlikely, in the next 10-20 years, to affect the prevalence of policyholders that meet the thresholds of the first two socioeconomics significance criteria, which are based on the prevalence of policies experiencing 18 percent or higher premium rate increases annually, would decline over time, and the impact of the preferred alternative on the costs of flood insurance would remain less than significant when considered in the cumulative context. Depending on the number of low cost policies siphoned off by the private flood insurance market (due to the availability of more competitive lower rates or the availability of greater coverage options and coverage limits), there could be increases in the cost of flood insurance for the remaining policies. However, this is a long term process, the effects of which would be mitigated by the fact that the policy attrition, and the resultant increases to the cost of flood insurance, would be spread out over number of years. As such, FEMA believes that the cumulative effects of private insurance and the preferred alternative on flood insurance coverage within flood zones and the costs of flood insurance would be less than significant.

Private flood insurance may, like the NFIP, support some local economic activity based on the portion of premiums that goes to local insurance offices and agents, or it may remove money from the local economy and thereby reduce local economic activity to some degree (in the short-term, but not in the long term if premiums that accrued to the NFIP return to the local economy as payments on flood damage claims). As subsidies are phased out and NFIP premium rates increase, some NFIP policyholders may switch to private flood insurance. The relative impact of private flood insurance removing money from a local economy compared to this impact of insurance through the NFIP is not known−it depends on the business practices of each private insurance company. What is clear is that any such impact, as with the NFIP, would be very small compared to total activity in any economy (see Section 4.3.1.2.2), and therefore less than significant.

Housing characteristics, population growth, and demographic patterns are driven by broad economic and social forces, as described in Sections 4.3.1.2.3 and 4.3.1.2.4. Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. The NFIP may discourage such development through its floodplain management standards and the CRS. The availability of private insurance would not alter those effects of the NFIP, with the possible exception that these effects would go away if a community chooses to no longer participate in the NFIP due to the availability of private flood insurance. FEMA believes that such cases, if any, would be very limited. Therefore, any cumulative impact would be less than significant. Cumulative impacts of the preferred alternative and private flood insurance on ecosystem services would be less than significant for the same reason: ecosystem services would only be affected in a cumulative sense if a community chooses to no longer participate in the NFIP due to the availability of private flood insurance and that community reduces its standards for floodplain development. FEMA believes that such cases, if any, would be very limited.

The preferred alternative requires communities to obtain and maintain documentation of compliance with the appropriate Federal or State laws, including the ESA, as a condition of issuing permits to develop in the floodplain. It also clarifies that issuing certain LOMC requests (i.e., map revisions) is contingent on the community or project proponent submitting documentation of compliance with the ESA. These components of the preferred alternative would result in less than significant impacts on public and private resources. Private flood insurers would have no ability to place requirements on communities or development project proponents. Therefore, the impact of the preferred alternative on public and private resources would remain less than significant in the cumulative context.

The NFIP reduces burdens on public health and safety services by reducing potential injuries and losses of life and property through effective management of the floodplain. It is possible that increases in premium rates under the preferred alternative could cause people to switch to private flood insurance or, in the case of new development, to initially choose private flood insurance instead of insurance throughout the NFIP. However, because all such cases would be in communities that are participating in the NFIP, the floodplain management benefits of the NFIP in reducing burdens on public health and safety services would still apply. (The preferred alternative does not apply to communities that are not participating in the NFIP.) The public health and safety services benefits of the NFIP would only go away if a community chooses to no longer participate in the NFIP. FEMA believes that such cases would be very limited. In addition, in any such cases, development would still be subject to local land use planning and permitting reviews that may identify and seek to reduce any increased burdens of development on public health and safety services. For these reasons, the cumulative impact (if any) of the preferred alternative and private flood insurance on public health and safety services would be less than significant.

With respect to environmental justice, if the preferred alternative causes some NFIP policyholders to switch to private flood insurance to obtain lower cost flood insurance, this would be a benefit to such policyholders and therefore no environmental justice issue would be created.

4.5.3.1.2 Federal Floodplain Development−Federal Agencies that Carry Out Development, Fund Activities, or Authorize Activities

Federal agencies that carry out, fund, or authorize development activities support the development of structures in the floodplain, whose owners and renters are potential purchasers of NFIP flood insurance policies. The effect of the addition of new NFIP policies on the cost of flood insurance would depend on whether the new policies are high risk, high cost policies or low risk, low cost policies. More high risk policies could increase the cost of flood insurance because of the cross-subsidization of such policies through grandfathering and the CRS program. Because any NFIP policies on new construction would likely be post-FIRM policies,[37] these policies are most likely lower risk, lower cost policies, so they are unlikely to cause significant increases in the cost of flood insurance. Therefore, the cumulative impact of the preferred alternative and Federal agencies that carry out, authorize, or fund development on the cost of flood insurance would remain less than significant in the cumulative context. Federal agencies that carry out, authorize, or fund development all support new economic activity that maintains or increases employment, and in the case of non-government development activity, maintains or increases tax revenues. The preferred alternative would not enable Federal agencies to carry out additional development, authorize new development, or fund additional development. Therefore, the preferred

[37] Communities where new construction could be classified as pre-FIRM would be either emergency phase or Non-Special Flood Hazard Areas (NSFHA), which are rare.

alternative would have no cumulative effect on economic characteristics (employment or tax revenues) when considered together with those Federal actions.

Housing characteristics, population growth, and demographic patterns are driven by broad economic and social forces, as described in Sections 4.3.1.2.3 and 4.3.1.2.4. Federal agencies that carry out, authorize, or fund development do so in response to larger economic and social forces. Federal agencies may have some effect on housing characteristics. For instance, some HUD housing affordability programs support multi-family housing development. Such effects are small relative to the effects of market drivers due to larger economic and social forces. Federal agencies do not have the regulatory or economic power to substantially influence population growth and demographic patterns. With respect to the NFIP, floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. The NFIP may discourage such development through its floodplain management standards and the CRS. As described in Section 4.3.1, the NFIP in general (No Action Alternative) has a less than significant impact on housing characteristics, population growth, and demographic patterns, and the preferred alternative does not create any additional impact on these aspects of socioeconomics. Given the marginal effects, if any, of both the NFIP and Federal agencies on housing characteristics, population growth, and demographic patterns, particularly relative to the effects of larger economic and social forces, the cumulative impact on housing characteristics, population growth, and demographic patterns from the preferred alternative and Federal agencies that carry out, authorize, or fund development would be less than significant.

Federal agencies that authorize activities have permitting and compliance requirements. Federal agencies that fund activities have application and compliance requirements. These requirements create demands on public and private resources. Federal agencies that carry out development must obtain local approvals, which creates some demands on public resources for project reviews. The relevant socioeconomic criterion, "Requires an amount of public or private resources (time and/or money) for compliance that substantially interferes with the performance of other local government functions or the viability of proposed projects" implicitly recognizes that both public and private parties experience demands on resources in the context of many demands on limited resources, including the demands noted above related to Federal agency activities. While the ESA compliance documentation requirements of the preferred alternative may create some additional demands on public and private resources, those demands would be very small (see Section 4.3.1.3). Even when considered together with demands generated by Federal agencies that carry out, authorize, or fund development, it is highly unlikely that the small demands on public and private resources from the preferred alternative would result in substantial interference with the performance of other local government functions or the viability of proposed projects. Thus, the impact of the preferred alternative would remain less than significant when considered in the cumulative context with Federal agencies that carry out, authorize, or fund development.

Federal agencies that carry out, authorize, or fund floodplain development have the potential to negatively impact ecosystem services. Because the preferred alternative does not involve funding, authorizing, undertaking, or encouraging floodplain development, it would not add cumulatively to any negative impacts on ecosystem services from Federal agencies that carry out, authorize, or fund development. Therefore, the preferred alternative in the cumulative context has no impact on ecosystem services.

The NFIP reduces burdens on public health and safety services by reducing potential injuries and losses of life and property through effective management of the floodplain. Federal agencies that carry out, authorize, or fund development activities could potentially create new burdens on public health and safety services. This is because the addition of more people and property associated with new development can sometimes mean that additional public resources need to be devoted to police, fire, ambulance and other public health and safety services. The preferred alternative would not add cumulatively to any such burdens because the NFIP reduces these types of burdens.

The environmental justice impact of the preferred alternative was determined in Section 4.3.1.3.5 to be less than significant, based on currently available information. Impacts primarily would be due to affordability concerns regarding the effects on low income populations of premium rate increases. FEMA's current work to develop a congressionally required affordability framework may provide additional data regarding any environmental justice effects of the preferred alternative and possible approaches to reducing those effects. Whether the preferred alternative has cumulative effects when considered together with Federal actions that carry out, fund, or authorize development activities depends on how those other Federal actions affect any environmental justice populations in the SFHA that are disproportionately impacted by premium rate increases. Relevant factors include the proximity of Federal projects to any environmental justice populations in the SFHA that are disproportionately impacted by premium rate increases, the size of those projects, the type(s) of adverse impacts of those projects, how Federal policies and programs affect environmental justice populations, and whether any adverse effects of other Federal projects, programs, and policies fall disproportionately on the affected environmental justice populations. In the absence of better information about affordability impacts of the preferred alternative−information that could then be considered in light of specific environmental justice effects of specific Federal actions to carry out, fund, or authorize development activities−FEMA maintains that the cumulative impact of the preferred alternative in combination with these other Federal actions would be less than significant.

4.5.3.1.3 Private Floodplain Development

Private floodplain development results in new structures in the floodplain, whose owners and renters are potential purchasers of NFIP flood insurance policies. The effect of the addition of new NFIP policies on new construction on the cost of flood insurance would depend on whether the new policies are high risk, high cost policies or low risk, low cost policies. More high risk policies could increase the cost of flood insurance because of the cross-subsidization of such policies through grandfathering and the CRS program. Because any new NFIP policies on new construction would likely be post-FIRM policies,[38] these policies are most likely lower risk, lower cost policies, so they are unlikely to cause significant increases in the cost of flood insurance. Therefore, the cumulative impact of the preferred alternative and private floodplain development on the cost of flood insurance would remain less than significant in the cumulative context.

Development results in new economic activity that supports or increases employment, and increases the tax base and tax revenues (Wardrip, Williams, & Hague, 2011). As discussed in Sections 4.1.1 and

[38] Ibid.

4.3.1.2.3, factors other than the NFIP drive development in the floodplain. Floodplain development is not authorized, funded, or carried out by FEMA pursuant to the NFIP, nor does it encourage such floodplain development to occur. Thus, the preferred alternative would not have a cumulative effect with private floodplain development on economic activities and tax revenues.

Private floodplain development is relevant to the criterion for housing characteristics and residential development patterns and the criterion for population growth and demographic patterns. Residential development—whether inside or outside the floodplain—adds housing units and population to communities, may change the nature of housing characteristics (e.g., mix of housing types), and may change development patterns (e.g., geographic extent and density) in communities. The NFIP does not enable private floodplain development; therefore, the preferred alternative would not have a cumulative effect with private floodplain development.

Private floodplain development creates demands on public and private resources. Developers must obtain local approvals, which creates demands on public resources for project reviews, including reviews for compliance with floodplain management standards adopted by communities to participate in the NFIP. Communities may pass on some of their review costs to the private development proponents. The impacts of the additional demands of the ESA compliance documentation requirements of the preferred alternative were assessed in Section 4.3.1.3 and found to be very small and therefore less than significant. Even when considered together with the other demands generated by private floodplain development, it is highly unlikely that the small demands on public and private resources from the preferred alternative would result in substantial interference with the performance of other local government functions or the viability of proposed projects. Thus, the impact of the preferred alternative would remain less than significant when considered in the cumulative context with private floodplain development.

Private floodplain development has potential to negatively impact ecosystem services by reducing the extent or quality of wetlands, removing vegetation, and increasing impervious cover (EPA, 2014) (Mori, 2010). Because the preferred alternative does not involve funding, authorizing, undertaking, or encouraging floodplain development, it would not add cumulatively to any negative impacts on ecosystem services from private floodplain development. Therefore, the preferred alternative in the cumulative context has no impact on ecosystem services.

The NFIP reduces burdens on public health and safety services by reducing potential injuries and losses of life and property through effective management of the floodplain. The preferred alternative has no impact on this effect of the NFIP. Private floodplain development could potentially create new burdens on public health and safety services, because additional people and property from new development sometimes require additional public resources be devoted to police, fire, ambulance and other public health and safety services (Mayberry, 2008). The preferred alternative would not add cumulatively to any such burdens because the NFIP reduces these types of burdens. For these reasons, the cumulative impact (if any) of the preferred alternative on public health and safety services would be less than significant.

With respect to environmental justice, private floodplain development that is not authorized, funded, or carried out by a Federal agency is outside the scope of this NPEIS. Consideration of environmental justice effects is only relevant in the NEPA context if there is a Federal action; e.g., a federally funded project or a development project carried out by a Federal agency. Such cases were considered above.

4.5.3.2 Land Use and Planning

Private flood insurance is becoming more available for commercial and residential properties. The availability of private flood insurance could affect the number of Federal flood insurance policyholders. However, this trend would not likely influence or drive changes in land use plans or other community plans at a community wide level. The availability of private flood insurance would not increase or decrease the overall levels of development or require the incorporation of new standards and practices into community ordinances.

Federal agencies that carry out, fund, or authorize development are required to comply with Federal environmental laws and regulations. However, there might be circumstances where government authorized, funded, or carried out projects could conflict with existing land use plans or other community plans or policies. Certain types of Federal development might be exempt or immune to local ordinances and zoning laws and regulations. Some of these exemptions derive from Federal law and Federal jurisdictional limitations. Other exemptions depend on criteria established typically at the State level and vary from State to State. Examples of criteria include the kind of development, the extent of the public interest served by the improvements, the impact on local interests, and the effect local land use plans or other community plans would have on the development. The application of existing land use plans and other community plans or policies vary based on the project and State requirements, and could conflict with a community's ability to obtain CRS credits to reduce insurance rates. Accordingly, development carried out, funded, or authorized by a Federal agency could conflict with existing land use plans or other community plans or policies, and could counteract any beneficial effects afforded to a community through implementation of Alternative 2.

Private floodplain development will continue to occur. However, its intensity and magnitude is difficult to foresee. Private development is required to comply with applicable laws and regulations, including existing land use plans or other community plans or policies. As a result, continued private development should not conflict with existing land use plans or other community plans. Any beneficial effects afforded to a community through implementation of Alternative 2 would not be affected.

4.5.3.3 Water Resources

Private flood insurance is becoming more available for commercial and residential properties. The availability of private flood insurance could affect the number of Federal flood insurance policyholders. However, this trend would not likely influence levels of development in the floodplain, nor would it influence how development or other activities are carried out in ways that would impact water resources. As a result, the availability of private flood insurance would not impact aquatic ecosystems, surface water and groundwater quality, and hydrologic characteristics such as floodplain function.

Federal agencies that authorize, fund, or carried out development are required to comply with Federal environmental laws and regulations, some of which regulate development in floodplains. Before development, the project proponent must document compliance with the Federal laws and regulations. The authorizing, funding, or undertaking of projects and subsequent construction could affect aquatic ecosystems, surface water or groundwater quality, or hydrologic characteristics. However, the compliance process is structured to minimize these impacts. For example, USACE authorizes projects that affect waters of the United States through a Federal permitting process. During the permit process, the USACE must consider compliance with other Federal laws and coordinate permit reviews with other Federal, State, and local agencies. Under this permit process, adverse impacts to the aquatic environment must be offset by mitigation requirements, which could include restoring, enhancing, creating, and preserving aquatic functions and values. The granting of USACE permits and the subsequent construction of permitted projects could affect floodplain function and characteristics. However, the permitting process is structured to minimize impacts to the aquatic environment. Thus, the permitting of projects by USACE would maintain or improve floodplain function and minimize or mitigate impacts to the aquatic environment.

Private floodplain development will continue to occur. However, its intensity and magnitude is difficult to foresee. The impacts from this development depend on the type of development and the location. Although impacts from individual private developments could be minimal, the cumulative effect of private development in floodplains could have a greater effect. The cumulative effects would be greater for private floodplain development within the same floodplain and within close proximity of each other. Without information about the location of private developments, the cumulative effects on water resources are difficult if not impossible to determine.

The availability of private insurance or development in the floodplain by either Federal or private entities would not affect FEMA's FIRM process, which would continue to provide broad-based awareness for communities.

4.5.3.4 Biological Resources

Private flood insurance is becoming more available for commercial and residential properties. As described in Section 4.5.3.1, the availability of private flood insurance could affect the number of Federal flood insurance policyholders. However, this trend would not likely influence levels of development in the floodplain, nor would it influence how development or other activities are carried out in ways that would impact biological resources. As a result, the availability of private flood insurance would not add to or detract from the less than significant beneficial impacts from the Preferred Alternative on vegetation, habitat loss, and the ecosystem functions of natural communities.

Destruction of habitat is a common threat resulting in jeopardy to ESA listed and other special status species. All floodplain development authorized, funded, or carried out is required to comply with Federal environmental laws and regulations. For example, the ESA requires all Federal agencies authorizing, funding, or undertaking programs review their actions under 50 C.F.R. 402 to determine if actions may affect ESA-listed species or critical habitat. Should the Federal agency authorizing, funding, or undertaking an action determine that an ESA-listed species or critical habitat may be affected, further consultation with the USFWS or NOAA Fisheries is required. Additionally, such Federal agencies may be required to modify their actions to ensure that such action will not jeopardize the continued survival of

ESA-listed species or adversely modify critical habitat. Similarly, for marine species and habitat, the Magnuson-Stevens Act (MSA) requires all Federal agencies authorizing, funding, or undertaking programs to determine if actions may affect Federal fishery management or EFH. The Migratory Bird Treaty Act (MBTA) prevents the taking of birds listed as migratory birds, including common songbirds, waterfowl, shorebirds, raptors, owls, crows, native doves and pigeons, swifts, and swallows. The Marine Mammal Protection Act protects marine mammals, whether listed or not, by generally prohibiting taking of marine mammals in United States waters. In accordance with the CWA Section 404 process, the USACE authorizes projects that affect United States waters through a Federal permitting process. During the permit process, the USACE must consider compliance with other Federal laws and coordinate permit reviews with other Federal, State, and local agencies. Under this permit process, adverse impacts to the aquatic environment must be offset by mitigation requirements, which could include restoring, enhancing, creating, and preserving aquatic functions and values. The granting of USACE permits and subsequent construction of permitted projects could affect floodplain function and characteristics. However, the permitting process is structured to minimize impacts to the aquatic environment. Thus, the permitting of projects by USACE would maintain or improve floodplain function and minimize or mitigate impacts to the aquatic environment. Thus, the authorizing, funding, or undertaking of projects and subsequent construction could affect vegetation, habitat loss, and the ecosystem function of natural communities; however, the ESA, MSA, MBTA, Marine Mammal Protection Act, and CWA compliance processes are structured to minimize these impacts. Therefore, Federal floodplain development would not add to or detract from the less than significant beneficial impacts from the Preferred Alternative on vegetation, habitat loss, and the ecosystem functions of natural communities.

Private floodplain development will continue to occur. However, its intensity and magnitude is difficult to foresee. The impacts from this development are dependent on the type of development and the location. Although impacts from individual private development projects could be minimal, the cumulative effect could be greater. Effects would be greater for private floodplain development within the same floodplain and within close proximity of each other. For example, access road and other infrastructure construction servicing new development may reduce or eliminate the connectivity of floral and faunal habitat (Rodrigue, 1998). However, Federal laws, permitting requirements, BMPs applied at the permitting phase, and other community-level mitigation measures minimize these impacts. Without information about the location of private developments, the cumulative impacts on biological resources are difficult if not impossible to determine. As FEMA does not authorize, fund, or undertake development, FEMA would not add to any impacts on biological resources of private floodplain development. However, because there may be significant impacts of private floodplain development carried out by others, there would likely be cumulative impacts to biological resources from those activities.

4.5.4 Irreversible and Irretrievable Commitment Of Resources

Irreversible and irretrievable commitment of resources consist of impacts on or losses to resources that cannot be recovered or reversed. This discussion involves only nonrenewable resources or resources that are renewable only over a very long period. Examples include permanent conversion of wetlands through fill or other means, loss of populations of endangered species, or riverbed erosion and sedimentation. All of the proposed alternatives would establish procedural requirements for FEMA's implementation of the

NFIP, specifically related to floodplain management, flood hazard mapping, and flood insurance. The proposed alternatives would not involve the undertaking of physical activities, such as floodplain development in the action area, nor would they involve the funding of such activities. The NFIP would not, pursuant to the proposed alternatives or otherwise, dictate what activities would or would not occur within floodplains. The power to regulate development in the floodplain, including requiring and approving permits, inspecting property, and citing violations, requires land use authority. The regulation of land use falls under the State's police powers, and the States delegate this power down to their respective political subdivisions. FEMA has no direct involvement in the administration of local floodplain management ordinances or in the permitting of local development in the floodplain. Additionally, there can be no irreversible and irretrievable resources lost due to the Alternatives because the alternatives are simply changes in policy or regulation that do not involve any physical activities that would lead to an irretrievable or irreversible commitment of resources.

4.5.5 Unavoidable Adverse Impacts

The CEQ NEPA implementing regulations (40 C.F.R. § 1502.16) require that an environmental impact statement evaluate the unavoidable adverse impacts from implementation of the Alternatives. All of the alternatives would establish procedural requirements for FEMA's implementation of the NFIP specifically related to floodplain management, flood hazard mapping, and flood insurance. These alternatives would not involve the undertaking of physical activities, such as floodplain development, in the action area, nor would they involve the funding of such activities. The NFIP would not, pursuant to the alternatives or otherwise, dictate what activities would or would not occur within floodplains. The power to regulate development in the floodplain, including requiring and approving permits, inspecting property, and citing violations, requires land use authority. The regulation of land use falls under the State's police powers, and the States delegate this power down to their respective political subdivisions. FEMA has no direct involvement in the administration of local floodplain management ordinances or in the permitting of local development in the floodplain. In addition, the alternatives do not have natural or depletable resource requirements because they are simply changes in policy or regulation that do not involve any physical activities for which resources would be required. For these Alternatives, the analysis indicates no significant or unavoidable adverse impacts are anticipated.

4.5.6 Relationship Between Short-term and Long-term Productivity

CEQ's *NEPA Implementing Regulations* (40 C.F.R. § 1502.16) require that the relationship between short-term use of the environment and the potential impacts of such use on the maintenance and enhancement of long-term productivity of the affected environment be addressed. Impacts that narrow the range of beneficial uses of the environment are of particular concern. Such impacts can arise from choosing one action that could reduce the flexibility of pursuing other options in the future. However, the alternatives neither authorize nor prohibit short-term uses of floodplains, and FEMA is not altering any current uses of the environment occurring in floodplains. It is anticipated that implementation of the alternatives would not result in any impacts that would narrow the range of future beneficial uses of the environment because it would not pose any long-term risks to the health, safety, or the general welfare of public communities.

REFERENCES

AECOM. (2013). *The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100*. Retrieved from http://www.aecom.com/content/wp-content/uploads/2016/06/Climate_Change_Report_AECOM_2013-06-11.pdf

AIR - Blais et al. (2006). *Managing Future Development Conditions in the National Flood Insurance Program.*

AIR - Monday et al. (2006). *An Evaluation of Compliance with the National Flood Insurance Program Part A: Achieving Community Compliance.* Washington DC: American Institutes for Research.

AIR - Rosenbaum, W. (2005). *Developmental and Environmental Impacts of the National Flood Insurance Program: A Review of Literature.* Retrieved from American Institutes for Research.

AIR - Sarmiento and Miller. (2006). *Costs and Consequences of Flooding and the Impact of the National Flood Insurance Program.* Washington, D.C.: American Institutes for Research. Retrieved February 25, 2014, from https://www.fema.gov/media-library/assets/documents/9513

AIR - Wetmore et al. (2006). *The Evaluation of the National Flood Insurance Program Final Report.* Washington, DC: American Institutes for Research. Retrieved January 1, 2015, from http://www.fema.gov/media-library-data/20130726-1602-20490-1463/nfip_eval_final_report.pdf

Alig, R., Kline, J., & Lichtenstein, M. (2003). *Urbanization on the US landscape: looking ahead in the 21st Century.* Retrieved June 2015, from http://128.193.112.13/lulcd/Publicationsalpha_files/Alig_etal_2004_LUP.pdf

Asabere, P. K., & Harvey, B. (1985). Factors Influencing the Value of Urban Land: Evidence from Halifax-Dartmouth. *Real Estate Economics, 13*(4), 361-377.

ASFPM. (2008, September 16). *Natural and Beneficial Floodplain Functions: Floodplain Management - More than Flood Loss Reduction.* Retrieved July 27, 2016, from https://www.floods.org/PDF/WhitePaper/ASFPM_NBF%20White_Paper_%200908.pdf

ASFPM. (2010). *"Building" effective State Floodplian Managment Programs: Strategic Planning Methodology and State Guidance.* Association of State Floodplain Managers. Retrieved June 16, 2016

Ashley County Ledger. (Undated). *Ashley County Ledger*. Retrieved from Raging Rivers Wild: A Look at the Flood of 1927: http://www.ashleycountyledger.com/articles/2015/06/16/history/z999.txt

Bin, O., & Polasky, S. (2003). *Effects of Flood Hazards on Property Values: Evidence Before and After Hurricane Floyd.* Retrieved October 18, 2016, from http://www.ecu.edu/cs-educ/econ/upload/ecu0306.pdf

Burby, R. J., Bollens, S. A., Holloway, J. M., Kaiser, E. J., Mullan, D., & Sheaffer, J. R. (1988). *Cities under water: A comparative evaluation of ten cities' efforts to manage floodplain land use.* Colorado.

CEQ. (1997b, January). *Considering Cumulative Effects under the National Environmental Policy Act.* Retrieved from http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf

CEQ. (2014, December). *Effective Use of Programmatic NEPA Reviews.* Retrieved from https://ceq.doe.gov/current_developments/docs/Effective_Use_of_Programmatic_NEPA_Reviews_Final_Dec2014_searchable.pdf

CEQ. (2016, August 5). *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change*. Retrieved June 2014, from https://www.federalregister.gov/documents/2016/08/05/2016-18620/final-guidance-for-federal-departments-and-agencies-on-consideration-of-greenhouse-gas-emissions-and

Cohn, D., & Caumont, A. (2016, March 31). *10 demographic trends that are shaping the U.S. and the world*. Retrieved October 29, 2016, from Pew Research Center: http://www.pewresearch.org/fact-tank/2016/03/31/10-demographic-trends-that-are-shaping-the-u-s-and-the-world/

Comptroller of the United States. (1982). *National Flood Insurance: Marginal Impact on Flood Plain Development, Administrative Improvements Needed.*

Congressional Research Service. (2013). *The National Flood Insurance Program: Status and Remaining Issues for Congress.* Retrieved December 2014, from http://fas.org/sgp/crs/misc/R42850.pdf

Cotten, S. J., & Murasko, J. L. (2013). *The Effect of Changes in Flood Insurance Premiums on Economic Activity in a Sub-Region of Harris County Precinct 2.* Prepared for Norex Engineering, Inc. Retrieved July 2016, from http://www.h-gac.com/community/water/rfmc/documents/BW-12_Final_Report_with_cover.pdf

Dahl, T.E. (2011). *Status and trends of wetlands in the conterminous United States 2004 to 2009.* Retrieved October 2013, from http://www.fws.gov/Wetlands/Documents/Status-and-Trends-of-Wetlands-in-the-Conterminous-United-States-2004-to-2009.pdf

EPA. (2014). *Our Built and Natural Environments: A Technical Review of the Interactions Among Land Use, Transportation, and Environmental Quality.* Office of Sustainable Communities, Smart Growth Program. Retrieved November 10, 2016, from https://www.epa.gov/smartgrowth/our-built-and-natural-environments

EPA. (2016, September 14). *Manage Flood Risk*. Retrieved from Green Infrastructure: https://www.epa.gov/green-infrastructure/manage-flood-risk

FEMA. (1981). *Evaluation of the Economic, Social and Environmental Effects of Floodplain Regulations.* Co-developed with the Department of Housing and Urban Development and the Department of

Commerce (National Oceanic and Atmospheric Administration). Retrieved March 2016, from https://www.gpo.gov/fdsys/pkg/CZIC-gb565-f66-e92-1981/html/CZIC-gb565-f66-e92-1981.htm

FEMA. (2002). *The Natural and Beneficial Functions of Floodplains: Reducing Flood Losses by Protecting and Restoring the Floodplain Environment.* A Report for Congress by the Task Force on the Natural and Beneficial Functions of the Floodplain (chaired by FEMA). Retrieved April 2016, from http://www.hud.gov/offices/cpd/environment/naturalfunct_flood_fema409.pdf

FEMA. (2005, June). *Reducing Damage from Localized Flooding: A Guide for Communities.* Retrieved from https://www.fema.gov/media-library-data/20130726-1446-20490-0539/FEMA511-complete.pdf

FEMA. (2010). *CRS Credit for Habitat Protection.* Retrieved February 2015, from http://www.fema.gov/pdf/about/regions/regionx/nfip_esa_guidance_docs/crs_credit_for_habitat_protection_final.pdf

FEMA. (2011, September). *Actuarial Rate Review in Support of the Recommended October 1, 2011 Rate and Rule Changes.* Retrieved from http://www.fema.gov/media-library-data/20130726-1809-25045-6893/actuarial_rate_review2011.pdf

FEMA. (2013b). *National Flood Insurance Program Community Rating System Coordinator's Manual. 2013 Edition.* Retrieved from https://www.fema.gov/media-library/assets/documents/8768?id=2434

FEMA. (2014). *FEMA Floodplain Management Losses Avoided Study.*

FEMA. (2015a). *Bulletin W-15005 - High Deductible Option Disclosure.* Memorandum for Write Your Own (WYO) Principal Coordinators and the National Flood Insurance Program (NFIP) Servicing Agent, Subject: High Deductible Option Disclosure (February 10). Retrieved July 2016, from http://nfipiservice.com/Stakeholder/pdf/bulletin/w-15005.pdf

FEMA. (2015b, March 30). *Final Report: Reducing Losses through Higher Regulatory Standards: Best Practices and Cost-Effective Strategies Report.* Retrieved from https://www.fema.gov/media-library-data/1429759809776-2d0be16f764d0e704aff1f7664334ba0/FEMA_CO_BestPractices_Strategies.pdf

FEMA. (2015c). *National Flood Insurance Program Biological Evaluation.* Version 2.0, Revised Draft dated December 28, 2015, Washington, DC.

FEMA. (2016a). *Communities Participating in the National Flood Program (Nation)*. Retrieved November 2016, from The National Flood Insurance Program Community Status Book: https://www.fema.gov/cis/nation.pdf

FEMA. (2016b). *Fact Sheet: Community Rating System.* May 2016. Retrieved August 18, 2016, from https://www.fema.gov/media-library/assets/documents/9998

FEMA. (2016c). *Flood Insurance Manual, April 2016.* Retrieved April 2016, from http://www.fema.gov/media-library/assets/documents/115549

FEMA. (2016d, July 11). *Policy Rates (Residential)*. Retrieved August 10, 2016, from FloodSmart.gov: https://www.floodsmart.gov/floodsmart/pages/residential_coverage/policy_rates.jsp

FEMA. (2016e, July 21). *Policy Rates (Non-Residential)*. Retrieved August 10, 2016, from FloodSmart.gov.

FEMA. (2016f). *Policy Statistics Country-Wide as of 7/31/2016*. Retrieved October 2016, from http://bsa.nfipstat.fema.gov/reports/1011.htm

FEMA. (2016g). *Public Purpose Floodplain Development: Economic Impact Assessment.*

FEMA. (2016h). *ESA-Related Performance Standard: Economic Impact Assessment.*

FEMA. (2016i). *Premium Rate Increases to Pre-FIRM Subsidized Policies: Economic Impact Assessment.*

FEMA. (2016k, July 21). *Understanding the Basics*. Retrieved August 10, 2016, from FloodSmart.gov: https://www.floodsmart.gov/floodsmart/pages/residential_coverage/understanding_the_basics.jsp

FEMA. (2017a). Personal Correspondence: Increase in Probation Surcharge.

FEMA. (2017b). Personal Correspondence: Installment Plan Payment Option.

Florida Office of Insurance Regulation. (2016). *Flood Insurance Writers in Florida*. Retrieved April 21, 2016, from http://www.floir.com/Sections/PandC/FloodInsurance/FloodInsuranceWritersFL.aspx

GAO. (2014). *Flood Insurance: Forgone Premiums Cannot Be Measured and FEMA Should Validate and Monitor Data System Changes.* United States Government Accountability Office. Retrieved March 2016, from http://www.gao.gov/products/GAO-15-111

GAO. (2016). *National Flood Insurance Program: Options for Providing Affordability Assistance.* United States Government Accountability Office. Retrieved March 2016, from http://www.gao.gov/products/GAO-16-190

Hurtibise, R. (2014). *Sun Sentinel*. Retrieved January 2015, from Private flood insurance offerings grow, but not for cheap subsidized policies: http://www.sun-sentinel.com/business/fl-private-flood-insurance-20140927-story.html

Ihrke, D. (2014). *Reason for Moving: 2012 to 2013.* U.S. Census Bureau. Retrieved October 29, 2016, from https://www.census.gov/content/dam/Census/library/publications/2014/demo/p20-574.pdf

Ingram, B. L. (2012). *California Megaflood: Lessons from a Forgotten Catastrophe*. Retrieved March 2015, from Scientific American: http://www.scientificamerican.com/article/atmospheric-rivers-california-megaflood-lessons-from-forgotten-catastrophe/?page=2

Insurance Journal. (2014). *Insurance Journal*. Retrieved January 2015, from House Subcommittee Renews Call for Private Flood Insurance: http://www.insurancejournal.com/news/national/2014/11/19/347507.htm

Knight, S. S., & Boyer, K. L. (2007, September). *Effects of Conservation Practices on Aquatic Habitats and Fauna.* Retrieved from Fish & Wildlife Response to Farm Bill Conservation Practices: https://www.fsa.usda.gov/Internet/FSA_File/chap_6.pdf

Kotkin, J. (2011). *The Sun Belt's Comeback*. Retrieved April 2014, from http://www.forbes.com/sites/joelkotkin/2011/12/22/the-sun-belts-comeback/

Krieger, K. &. (2015). Limits of insurance as risk governance. *The London School of Economics and Political Science*(80). Retrieved from file:///C:/Users/557712/Downloads/DP-Krieger-Demeritt.pdf

Maantay, J., & Maroko, A. (2009). Mapping urban risk: Flood hazards, race, & environmental justice in New York. *Applied Geography, 29*, 111-124. Retrieved February 2016, from https://www.researchgate.net/publication/40835074_Mapping_Urban_Risk_Flood_Hazards_Race_Environmental_Justice_In_New_York

Mayberry, B. C. (2008). *Impact Fees for Public Safety Facilities, City of Dover, New Hampshire.* Report prepared for the Department of Planning and Community Development, City of Dover, 2nd draft, September 18.

Miller, R. E., & Blair, P. D. (2009). *Input-Output Analysis: Foundations and Extensions.* Cambridge, UK: Cambridge University Press.

Mori, K. (2010). Can we avoid overdevelopment of river floodplains by economic policies?: A case study of the Ouse catchment (Yorkshire) in the UK. *Land Use Policy*, 976-982. Retrieved November 8, 2016

Nance, E. (2015). Exploring the impacts of flood insurance reform on vulnerable communities. *International Journal of Disaster Risk Reduction, 13*, 20-36. Retrieved April 2016, from http://www.sciencedirect.com/science/article/pii/S2212420915000242

National Park Service. (1995). *Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors.* Fourth Edition, prepared by Rivers, Trails and Conservation Assistance Program. Retrieved April 2016, from https://www.nps.gov/pwro/rtca/econ_all.pdf

National Research Council of the National Academies. (2015a). *Affordability of National Flood Insurance Program Premiums - Report 1.* Retrieved February 2016, from http://www.nap.edu/catalog/21709/affordability-of-national-flood-insurance-program-premiums-report-1

National Research Council of the National Academies. (2015b). *Affordability of National Flood Insurance Program Premiums – Report 2.* Washington, DC: The National Academies Press.

Retrieved February 2016, from http://www.nap.edu/catalog/21848/affordability-of-national-flood-insurance-program-premiums-report-2

Natural Hazards Research and Applications Information Center. (1992). *Floodplain Management in the United States: An Assessment Report.* Retrieved December 2013, from http://www.fema.gov/media-library/assets/documents/432

New York Times. (1862). *THE GREAT FLOOD IN CALIFORNIA: Great Destruction of Property Damage $10,000,000*. Retrieved March 2015, from The New York Times: http://www.nytimes.com/1862/01/21/news/the-great-flood-in-california-great-destruction-of-property-damage-10000000.html

NOAA. (2016). *Hydrologic Reconnection*. Retrieved from Restoration Center: http://www.habitat.noaa.gov/restoration/approaches/hydrologicrestoration.html

NOAA Fisheries. (2015b). *What is Essential Fish Habitat?* Retrieved February 4, 2015, from http://www.habitat.noaa.gov/protection/efh/index.html

Office of Management and Budget. (2003). *Circular A-4, Regulatory Analysis.* Retrieved August 8, 2016, from https://www.whitehouse.gov/omb/circulars_a004_a-4

Ortman, J. M., Velkoff, V. A., & Hogan, H. (2014). *An Aging Nation: The Older Population in the United States.* U.S. Census Bureau. Retrieved October 17, 2016, from https://www.census.gov/prod/2014pubs/p25-1140.pdf

Pennsylvania Insurance Department. (2016). *Licensed Insurance Companies*. Retrieved 2016, from http://www.insurance.pa.gov/Coverage/Pages/Licensed-Insurance-Companies.aspx#.VxcMXfkrKM8

Rodrigue, J.-P. P. (1998). *The Environmental Impacts of Transportation*. Retrieved from The Geography of Transportation Systems: https://people.hofstra.edu/geotrans/eng/ch8en/conc8en/ch8c1en.html

Rosenbaum, W., & Boulware, G. (2006). *The Developmental and Environmental Impact of the National Flood Insurance Program: A Summary Research Report.* Retrieved from http://www.fema.gov/media-library-data/20130726-1602-20490-5762/nfip_eval_dei_summary_report.pdf

Scott, M. F. (1989). *A new view of economic growth.* Oxford, England: Clarendon Press.

Shah, N. (2014, March 27). Smallville, USA, Fades Further: Migration Trend Underlines Economic Shift as Young People Chase Jobs in Cities. *Wall Street Journal*. Retrieved August 19, 2016, from http://www.wsj.com/articles/SB10001424052702303325204579463761632103386

The Nature Conservancy. (2014a). *A Flood of Benefits: Using Green Infrastructure to Reduce Flood Risks.* Retrieved from Habitat Protection and Restoration: https://www.conservationgateway.org/ConservationPractices/Freshwater/HabitatProtectionandRe storation/Documents/A%20Flood%20of%20Benefits%20-%20J.Opperman%20-%20May%202014.pdf

The Nature Conservancy. (2014b, September). *Watershed Approach Handbook: Improving Outcomes and Increasing Benefits Associated with Wetland and Stream Restoration and Protection Projects.* Retrieved from Habitat Protection and Restoration: https://www.conservationgateway.org/ConservationPractices/Documents/Watershed%20Approach%20Handbook%20Final.pdf

The New York Times. (2015, April 2). Federal Flood Insurance Premiums for Homeowners Rise. *New York Times*. Retrieved April 2016, from http://www.nytimes.com/2015/04/03/your-money/federal-flood-insurance-premiums-for-homeowners-rise-as-much-as-25-percent.html?_r=1

U.S. Bureau of Economic Analysis. (2016). *Gross Domestic Product by State: First Quarter 2016.* BEA 16-39; Table 3. Retrieved October 2016, from http://www.bea.gov/newsreleases/regional/gdp_state/2016/qgsp0716.htm

U.S. Census Bureau. (2013a, July 17). *Group Quarters and Housing Unit Estimates Terms and Definitions*. Retrieved August 19, 2016, from Population Estimates: https://www.census.gov/popest/about/terms/housing.html

U.S. Census Bureau. (2015). *American Housing Survey, Table C-01-AH, General Housing Data - All Units.* Obtained via U.S. Census Bureau American FactFinder data tool. Retrieved November 11, 2016, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=AHS_2013_C01AH&prodType=table

U.S. Census Bureau. (2016a). *2015 American Community Survey 1-Year Estimates, Table B25082, Aggregate Value (Dollars) by Mortgage Status.* Retrieved October 18, 2016, from http://factfinder.census.gov

U.S. Census Bureau. (2016b). *2010-2014 American Community Survey, Table DP04, Selected Housing Characteristics.* Retrieved August 8, 2016, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_DP04&prodType=table

U.S. Census Bureau. (2016c). *Annual Survey of State and Local Government Finances and Census of Governments (2012).* File "IndFin12a.txt" within zipped data file "_IndFin_1967-2012.zip". Retrieved November 4, 2016, from http://www2.census.gov/pub/outgoing/govs/special60/

U.S. Census Bureau. (2016d, September). *Building Permits Survey: Permits by State: Annual Data.* Retrieved from http://www.census.gov/construction/bps/stateannual.html

USACE. (1993). *Massachusetts Natural Valley Storage.* Retrieved from file:///C:/Users/543944/Downloads/ADA336720.pdf

USFWS & NOAA Fisheries. (1998). *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act, Final.*

USFWS. (2015, June). *Water Quality*. Retrieved from Contaminants: http://www.fws.gov/ecological-services/habitat-conservation/water-quality.html

Wardrip, K., Williams, L., & Hague, S. (2011). *The Role of Affordable Housing in Creating Jobs and Stimulating Local Economic Development: A Review of the Literature.* Center for Housing Policy. Retrieved November 12, 2016, from http://www2.nhc.org/media/files/Housing-and-Economic-Development-Report-2011.pdf

Webley, K. (2011). *Top 10 Historic U.S. Floods*. Retrieved March 2015, from Time: http://content.time.com/time/specials/packages/article/0,28804,2070796_2070798_2070793,00.html

Page Intentionally Left Blank.

5 LIST OF PREPARERS AND CONTRIBUTORS

BOOZ ALLEN HAMILTON

John Allendorf
B.A., Geography, Valparaiso University, Indiana

Derek Anderson
M.A., Historic Preservation, University of Maryland
B.A., History and Political Science, Florida State University

Erik Anderson
M.A.S., Environmental Policy & Management, University of Denver
B.S., Civil & Environmental Engineering, Utah State University

Sari Atchue
B.S., Environmental Science, University of Mary Washington

Maria (Paz) de la Paz Aviles
M.S., Environmental Management & Planning, Johns Hopkins University
B.S., Biological Resources Engineering, University of Maryland

Courtney Blann
M.B.A., Strategy & Sustainability, Case Western Reserve University
B.A., Journalism, University of Arkansas

Kurt Buchholz
M.S., Ecology and Marine Science, University of Connecticut
B.S., Marine Science and Biology, Long Island University

Christine Dawson
M.F.A., Historic Preservation, Savannah College of Art and Design
B.A., Philosophy

Christopher Franke
B.S., Environmental Soil & Water Science, University of Arkansas

Melissa French
M.S., Environmental Science & Policy, Johns Hopkins University
B.S., Business, Virginia Tech

Kelly Gardner
B.A., Classics and American Government, University of Virginia

Jared Gunnerson
M.P.A., Natural Resource & Environmental Management, University of Utah
B.A., Political Science, Utah State University

Katie Hite
M.S., Soil & Water Science, University of Florida
B.S., Environmental Science, Virginia Tech

Olwen Huxley
M.A., Energy & Environmental Analysis, Boston University
B.A., History and Science, Harvard-Radcliffe College

Chelsea Kempf
B.S., Biology, Texas A&M University

Pamela Middleton
M.A.S., Environmental Policy & Management, University of Denver
B.A., Biology, Sonoma State University

Jennifer Nystrom
M.S., Ecology and Evolutionary Biology, University of Michigan
B.A., Evolutionary and Environmental Biology, Dartmouth College

Richard Pinkham
M.S., Natural Resources Policy and Resource Economics, Cornell University
B.A., Geography, Dartmouth College

Marshall Popkin, PMP®
M.S., Environmental Science & Policy, Johns Hopkins University
B.S., Geology, College of William and Mary

Jennifer Salerno
M.S., Environmental Studies, American University
B.S., Biology, University of Maryland at College Park

Rachel Schneider
Ph.D., Environmental Engineering & Science, Oregon Health and Science University
M.S., Environmental Engineering & Science, Oregon Health and Science University
B.A., Chemistry, Goucher College

Miles Spenrath
B.S., Environment and Natural Resources, Ohio State University

Joe Tomberlin
M.H.P., Historic Preservation, Georgia State University
B.A., History, Oglethorpe University

Lindsey Veas, PMP®
M.A., Public Policy of the Environment & Natural Resources, George Washington University
B.S., Biology, George Washington University

Kara Westerfield
M.S., Natural Resources, Virginia Tech
B.S., Geology and Environmental Science, Mary Washington University

Caitlin Willoughby
M.L.S., Library & Informational Science, Simmons College
B.A., Geology and Environmental Science, Hartwick College

Brian Wooldredge
B.S., Environmental Studies and Physics, Gettysburg College

URS GROUP

Angela Chaisson, CWB®
B.S., Wildlife Resources, West Virginia University

Brian Boose, CEP
B.S., Biological Sciences/Ecology, University of California: Davis

Brad Burford, AWB®
M.S., Biology, Clarion University of Pennsylvania
B.S., Wildlife and Fisheries, Pennsylvania State University: University Park Campus

Michael Busam, AWB®
B.S., Environmental Science and Policy, University of Maryland: College Park

Edward Hagarty, PE
D.Sc., Engineering Management, George Washington University
M.S., Civil Engineering, North Carolina State University
B.S. Civil Engineering, North Carolina State University

Whitney Kirkendall
M.S., Geophysics, Colorado School of Mines
B.S., Geology & Geophysics, University of Texas: Austin

Rosemary Laird
M.S., Marine Science, College of William and Mary
B.S., Conservation Resource Studies (with High Honors), University of California: Berkeley

Stephanie Liguori
B.S., Environmental Science, Delaware Valley University

Tammy Lim
M.A., Ecology and Systematic Biology, San Francisco State University
B.S., Wildlife, Fish and Conservation Biology, University of California: Davis

Mandi McElroy
M.S., Wildlife Ecology and Management, University of Georgia
B.S., Wildlife Biology, University of Georgia

Shane Parson, PE
Ph.D., Agricultural and Biological Engineering, Pennsylvania State University: University Park
M.S., Agricultural and Biological Engineering, Pennsylvania State University: University Park
B.S., Agricultural and Biological Engineering, Virginia Polytechnical Institute and State University

David Pecora
B.S., Marine Biology, Kutztown University of Pennsylvania

Ivy Porpotage
M.F.A., Creative Writing, American University
B.S., Chemical Engineering, University of Virginia

Lorena Solorzano-Vincent
M.S., Conservation Biology, Stanford University
B.S., Biology, University of Virginia

Jenny Tolbert
B.S., Environmental Resource Management, Pennsylvania State University: University Park

Mark Turner
M.S., Biology, Marshall University
B.S., Ecology, Prescott College

6 DISTRIBUTION LIST / INTERESTED STAKEHOLDERS

6.1 FEDERAL AGENCIES

Advisory Council on Historic Preservation

Environmental Protection Agency

Federal Emergency Management Agency

General Services Administration

National Oceanic and Atmospheric Adminsitration

National Marine Fisheries Service

Tennessee Valley Authority

U.S. Air Force

U.S. Army Corps of Engineers

U.S. Department of Homeland Security

U.S. Department of Transportation

U.S. Fish and Wildlife Service

U.S. Geological Survey

U.S. Global Change Research Program

6.2 MEMBERS OF CONGRESS

Senator Jeff Merkley (Oregon)

6.3 STATE AGENCIES

Hawaii State Civil Defense

Maryland Department of Natural Resources

Oregon Department of Land Conservation and Development

State of Nebraska

State of New Hampshire

State of South Dakota

6.4 CITY GOVERNMENTS

City of Boston, Massachusetts

Cochise County, Arizona

City of New York, New York

City of Oceanside, California

City of Port Huron, Michigan

City of Portland, Oregon

City of Redlands, California

City of Raleigh, North Carolina

City of Scottsdale, Arizona

Clallam County, Washington

Clark County, Nevada

King County, Washington

Maricopa County, Arizona

Madeira Beach, Florida

New York City Mayor's Office

New York City Office of Management and Budget

Papio-Missouri River Natural Resources District, Nebraska

Pinal County Department of Public Works, Arizona

Pinellas County, Florida

Upper Merion Township, Pennsylvania

Portsmouth, Virginia

Town of Coopertown, Tennessee

Town of Longboat Key, Florida

Vermont Department of Environmental Conservation

Washington Department of Ecology

6.5 ORGANIZATIONS

American Rivers

Association of State Floodplain Managers

Audubon Society of Portland

California Coastal Commission

California Delta Stewardship Council

California Farm Bureau Federation

Center for Biological Diversity

Defenders of Wildlife

Energy and Wildlife Action Coalition

Fort Bend Flood Management Association

Goulston & Storrs

Husch Blackwell

Mississippi River Network

National Association of Home Builders

National Association of Flood and Stormwater Management Agencies

National Emergency Management Association

National Flood Determination Association

Natural Resources Defense Council

National Wildlife Federation

Nicollet Island Coalition

Oregonians for Floodplain Protection

Outer Banks Association of Realtors

Outer Banks Home Builders Association

Pew Trusts

Rural Counties

San Antonio River Authority

Santa Clara Valley Water District

Sierra Club

Water Protection Network

Willamette Partnership

6.6 INTERESTED PUBLIC

John McShane

Maxime Tanis

Edward A. Thomas, Esq.

John D. Wiener, J.D., Ph.D.

Page Intentionally Left Blank.

Page Intentionally Left Blank.

NATIONAL FLOOD
INSURANCE PROGRAM