DECISION DOCUMENT
NATIONWIDE PERMIT 13

This document discusses the factors considered by the Corps of Engineers (Corps) during the issuance process for this Nationwide Permit (NWP). This document contains: (1) the public interest review required by Corps regulations at 33 CFR 320.4(a)(1) and (2); (2) a discussion of the environmental considerations necessary to comply with the National Environmental Policy Act; and (3) the impact analysis specified in Subparts C through F of the 404(b)(1) Guidelines (40 CFR Part 230). This evaluation of the NWP includes a discussion of compliance with applicable laws, consideration of public comments, an alternatives analysis, and a general assessment of individual and cumulative environmental effects, including the general potential effects on each of the public interest factors specified at 33 CFR 320.4(a).

1.0 Text of the Nationwide Permit

Bank Stabilization. Bank stabilization activities necessary for erosion control or prevention, such as vegetative stabilization, bioengineering, sills, rip rap, revetment, gabion baskets, stream barbs, and bulkheads, or combinations of bank stabilization techniques, provided the activity meets all of the following criteria:

(a) No material is placed in excess of the minimum needed for erosion protection;

(b) The activity is no more than 500 feet in length along the bank, unless the district engineer waives this criterion by making a written determination concluding that the discharge will result in no more than minimal adverse environmental effects (an exception is for bulkheads – the district engineer cannot issue a waiver for a bulkhead that is greater than 1,000 feet in length along the bank);

(c) The activity will not exceed an average of one cubic yard per running foot, as measured along the length of the treated bank, below the plane of the ordinary high water mark or the high tide line, unless the district engineer waives this criterion by making a written determination concluding that the discharge will result in no more than minimal adverse environmental effects;

(d) The activity does not involve discharges of dredged or fill material into special aquatic sites, unless the district engineer waives this criterion by making a written determination concluding that the discharge will result in no more than minimal adverse environmental effects;

(e) No material is of a type, or is placed in any location, or in any manner, that will impair surface water flow into or out of any waters of the United States;

(f) No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored native trees and treetops may be used in low energy areas);

(g) Native plants appropriate for current site conditions, including salinity, must be used for bioengineering or vegetative bank stabilization;

(h) The activity is not a stream channelization activity; and

(i) The activity must be properly maintained, which may require repairing it after severe storms or erosion events. This NWP authorizes those maintenance and repair activities if they require authorization.

This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to construct the bank stabilization activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After construction, temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if the bank stabilization activity: (1) involves discharges into special aquatic sites; or (2) is in excess of 500 feet in length; or (3) will involve the discharge of greater than an average of one cubic yard per running foot as measured along the length of the treated bank, below the plane of the ordinary high water mark or the high tide line. (See general condition 32.) (Authorities: Sections 10 and 404)

1.1 Requirements

General conditions of the NWPs are in the Federal Register notice announcing the issuance of this NWP. Pre-construction notification requirements, additional conditions, limitations, and restrictions are in 33 CFR part 330.

1.2 Statutory Authorities

- Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403)
- Section 404 of the Clean Water Act (33 U.S.C. 1344)

1.3 Compliance with Related Laws (33 CFR 320.3)

1.3.1 General

NWPs are a type of general permit designed to authorize certain activities that have no more

than minimal individual and cumulative adverse environmental effects and generally comply with the related laws cited in 33 CFR 320.3. Activities that result in more than minimal individual and cumulative adverse environmental effects cannot be authorized by NWPs. Individual review of each activity authorized by an NWP will not normally be performed, except when pre-construction notification to the Corps is required or when an applicant requests verification that an activity complies with an NWP. Potential adverse impacts and compliance with the laws cited in 33 CFR 320.3 are controlled by the terms and conditions of each NWP, regional and case-specific conditions, and the review process that is undertaken prior to the issuance of NWPs.

The evaluation of this NWP, and related documentation, considers compliance with each of the following laws, where applicable: Sections 401, 402, and 404 of the Clean Water Act; Section 307(c) of the Coastal Zone Management Act of 1972, as amended; Section 302 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended; the National Environmental Policy Act of 1969; the Fish and Wildlife Act of 1956; the Migratory Marine Game-Fish Act; the Fish and Wildlife Coordination Act, the Federal Power Act of 1920, as amended; the National Historic Preservation Act of 1966; the Interstate Land Sales Full Disclosure Act; the Endangered Species Act; the Deepwater Port Act of 1974; the Marine Mammal Protection Act of 1972; Section 7(a) of the Wild and Scenic Rivers Act; the Ocean Thermal Energy Act of 1980; the National Fishing Enhancement Act of 1984; the Magnuson-Stevens Fishery and Conservation and Management Act, the Bald and Golden Eagle Protection Act; and the Migratory Bird Treaty Act. In addition, compliance of the NWP with other Federal requirements, such as Executive Orders and Federal regulations addressing issues such as floodplains, essential fish habitat, and critical resource waters is considered.

1.3.2 Terms and Conditions

Many NWPs have pre-construction notification requirements that trigger case-by-case review of certain activities. Two NWP general conditions require case-by-case review of all activities that may adversely affect Federally-listed endangered or threatened species or historic properties (i.e., general conditions 18 and 20, respectively). General condition 16 restricts the use of NWPs for activities that are located in Federally-designated wild and scenic rivers. None of the NWPs authorize the construction of artificial reefs. General condition 28 prohibits the use of an NWP with other NWPs, except when the acreage loss of waters of the United States does not exceed the highest specified acreage limit of the NWPs used to authorize the single and complete project.

In some cases, activities authorized by an NWP may require other federal, state, or local authorizations. Examples of such cases include, but are not limited to: activities that are in marine sanctuaries or affect marine sanctuaries or marine mammals; the ownership, construction, location, and operation of ocean thermal conversion facilities or deep water ports beyond the territorial seas; activities that result in discharges of dredged or fill material into waters of the United States and require Clean Water Act Section 401 water quality certification; or activities in a state operating under a coastal zone management program approved by the Secretary of Commerce under the Coastal Zone Management Act. In such

cases, a provision of the NWPs states that an NWP does not obviate the need to obtain other authorizations required by law. [33 CFR 330.4(b)(2)]

Additional safeguards include provisions that allow the Chief of Engineers, division engineers, and/or district engineers to: assert discretionary authority and require an individual permit for a specific activity; modify NWPs for specific activities by adding special conditions on a case-by-case basis; add conditions on a regional or nationwide basis to certain NWPs; or take action to suspend or revoke an NWP or NWP authorization for activities within a region or state. Regional conditions are imposed to protect important regional concerns and resources. [33 CFR 330.4(e) and 330.5]

1.3.3 Review Process

The analyses in this document and the coordination that was undertaken prior to the issuance of the NWP fulfill the requirements of the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act, and other acts promulgated to protect the quality of the environment.

All NWPs that authorize activities that may result in discharges into waters of the United States require water quality certification. NWPs that authorize activities within, or affecting land or water uses within a state that has a Federally-approved coastal zone management program, must also be certified as consistent with the state's program. The procedures to ensure that the NWPs comply with these laws are described in 33 CFR 330.4(c) and (d), respectively.

1.4 Public Comment and Response

For a summary of the public comments received in response to the June 1, 2016, Federal Register notice, refer to the preamble in the Federal Register notice announcing the reissuance of this NWP. The substantive comments received in response to the June 1, 2016, Federal Register notice were used to improve the NWP by changing NWP terms and limits, pre-construction notification requirements, and/or NWP general conditions, as necessary.

We proposed to modify the first paragraph of this NWP to clarify that it authorizes a wide variety of bank stabilization measures. In addition, we proposed to modify paragraph (c) to clarify that the quantity of the dredged or fill material discharged into waters of the United States must not exceed one cubic yard per running foot below the plane of the ordinary high water mark or the high tide line, as measured along the bank.

Many commenters supported the reissuance of this NWP, including many of the proposed changes. Many commenters objected to the reissuance of this NWP. Several commenters said that all bank stabilization activities should require individual permits. One commenter asserted that this NWP should not authorize new bank stabilization activities. One commenter stated that NWP 13 should not be used to create more land. One commenter

opined that the use of NWP 13 is contrary to the public interest because the only positive value of a bulkhead is limited to the landowner, and bulkheads have adverse impacts that affect society as a whole. One commenter said that this NWP should not be reissued because it does not comply with the requirements of section 404 of the Clean Water Act.

We are reissuing this NWP, with some changes made in response to comments that are discussed below. Many bank stabilization activities have no more than minimal individual and cumulative adverse environmental effects and are appropriate for NWP authorization. The Corps' regulations recognize that landowners have the general right to protect their property from erosion (33 CFR 320.4(g)(2)). The terms and conditions of this NWP provide a means of implementing this provision of the Corps' regulations by authorizing bank stabilization activities that can be conducted with minimal amounts of dredged or fill material being discharged into waters of the United States.

We acknowledge that bank stabilization will have indirect adverse effects on streams, rivers, lakes, estuaries, and oceans. In coastal waters, bank stabilization structures change natural shoreline processes and alter habitats (Nordstrom 2014). Bank stabilization structures in coastal waters create barriers to animal movements between habitats, cause the loss of some habitat, reduce or eliminate intertidal habitats, and alter species richness and abundance (Nordstrom 2014). Gittman et al. (2016) concluded after conducting a meta-analysis of coastal shore protection measures that a 23 percent decline in biodiversity and a 45 percent decline in organism abundance occurred near bulkheads and seawalls. Stone revetments, sills, and breakwaters exhibited little or no difference in biodiversity and organism abundance compared to natural shorelines (Gittman et al. 2016). In rivers and streams, bank stabilization measures such as riprap affect riverine processes including sediment transport, hydrodynamics, water levels, sediment input, sediment characteristics of the river or stream bed, and wood input (Reid and Church 2015). Riprap to stabilize river and stream banks also alters habitat quality and vertebrate and invertebrate populations (Reid and Church 2015).

We believe that in most cases, the indirect adverse environmental effects caused by bank stabilization authorized by NWP 13 are no more than minimal. While bank stabilization may result in some losses of waters of the United States along the stream or river bank or along the shore, the waterbody itself is not lost and that waterbody continues to provide ecological functions and services. For those activities that require PCNs, district engineers will review those activities and their direct and indirect adverse environmental effects. If a proposed bank stabilization activity will result in more than minimal individual and cumulative adverse environmental effects after the district engineer considers the applicant's mitigation proposal, he or she will exercise discretionary authority and require an individual permit. This NWP authorizes new bank stabilization activities and the modification, repair, or replacement of existing bank stabilization activities as long as those activities comply with the terms and conditions of the NWP.

Paragraph (a) of this NWP requires that the amount of material placed in jurisdictional waters and wetlands for the bank stabilization activity must be the minimum necessary for erosion protection. Therefore, this NWP does not authorize activities that create more land for property owner or the reclamation of previously lost lands. Bank stabilization activities

authorized by this NWP, including bulkheads, revetments, and other erosion control approaches, are conducted not only for private property, but for public property as well. Therefore, it cannot be stated that NWP 13 activities only benefit private landowners; the NWP can also benefit larger communities especially at waterfront parks and other public spaces along shorelines that are eroding. In the national decision document, we have completed a 404(b)(1) Guidelines analysis and determined that the reissuance of this NWP complies with the Guidelines.

Many commenters stated that the construction of bulkheads, seawalls, revetments, and other shoreline hardening structures should not be authorized by this NWP, and they should require individual permits. One commenter said that gabion baskets, sills, and stream barbs should not be authorized by NWP 13. Two commenters suggested replacing the words "such as" with "including, but not limited to" to the list of examples of activities authorized by this NWP to clarify that the list is not an all-inclusive list. Several commenters expressed their support of including hybrid bank stabilization activities that combine vegetated slope protection and riprap protection.

In the June 1, 2016, proposed rule, we proposed to modify the text of this NWP to make it clear that NWP 13 authorizes a variety of bank stabilization activities, not just the construction and maintenance of bulkheads, seawalls, revetments, gabion baskets, and other shoreline hardening structures. The construction and maintenance of bulkheads, seawalls, revetments, gabion baskets, etc. has, especially in waterbodies in urban areas, no more than minimal adverse environmental effects. This NWP can be used to authorize vegetative stabilization and bioengineering to reduce erosion, as well as other bank stabilization techniques. Stream barbs can be effective at reducing bank erosion and can have fewer adverse effects to streams and their banks than armoring the stream bank. Sills have been authorized by NWP 13 in the past and help protect existing fringe marshes from erosion. The use of the phrase "such as" in the first paragraph of NWP 13 makes it clear that the list of bank stabilization activities is not an exhaustive list. Other types of bank stabilization activities can be authorized by NWP 13 as long as those activities comply with the terms and conditions of this NWP.

One commenter stated that NWP 13 should be modified to prohibit hard bank stabilization structures landward of, or directly adjacent to, tidal marshes, mangroves, or submerged aquatic vegetation. One commenter stated that this NWP should not authorize bank stabilization activities in coastal estuaries. One commenter suggested adding a provision to NWP 13 to encourage the use of living shorelines as bank stabilization and erosion prevention methods. Several commenters voiced their support that NWP 13 not specify a preference for one bank stabilization approach over another approach.

This NWP requires PCNs for any proposed activities that involve discharges of dredged or fill material into special aquatic sites, including wetlands and vegetated shallows. Constructing bank stabilization activities, including bulkheads and revetments, landward of tidal marshes, mangroves, or submerged aquatic vegetation is a means of complying with paragraph (a) of general condition 23, mitigation, by minimizing adverse effects to those special aquatic sites. If the bank stabilization activity is constructed landward of the high tide line and there are no jurisdictional wetlands or waters at the proposed site for the bank

stabilization activity, then DA authorization is not required. Many areas of coastal estuaries are subject to strong wave energies and other erosive forces (e.g., large vessel wakes) where the construction of seawalls, bulkheads, or revetments is the only effective and sustainable bank stabilization technique.

We are issuing a separate NWP to authorize discharges of dredged or fill material into waters of the United States and structure or work in navigable waters of the United States for the construction and maintenance of living shorelines. That new NWP gives coastal landowners another option to protect their property from erosion. We agree that the NWPs should not establish a preference for one approach to bank stabilization over other approaches. The science surrounding living shorelines is relatively new and their long-term effectiveness compared to other bank stabilization methods has not been well studied (Saleh and Weinstein 2016). Therefore, at this time it would be premature to establish a regulatory preference for living shorelines.

Landowners can seek advice from consultants regarding which bank stabilization approach will be suitable and sustainable under the conditions at a particular site. District engineers will evaluate NWP PCNs and voluntary requests for NWP verification to determine whether the proposed bank stabilization activity qualifies for NWP authorization. Corps district staff cannot design bank stabilization activities for landowners because it would create liability for the federal government. Some general advice can be offered to landowners, but it is up to the landowner to decide how he or she wants to protect his or her property from erosion. Corps district staff can only evaluate the applicant's proposal and determine whether it qualifies for NWP or regional general permit authorization or requires an individual permit.

Several commenters stated that NWP 13 should not be reissued because too much shoreline has been armored by bank stabilization activities. These commenters cited a study that determined that 14 percent of the coastal shorelines along the Atlantic and Pacific Oceans and the Gulf of Mexico have been altered by the construction of bulkheads, seawalls, jetties, and groins (Gittman et al. 2015). One commenter said stated that NWP 13 should not authorize hard bank stabilization structures on public beaches. Another commenter expressed the opinion that hardened bank stabilization projects should only be authorized in cases where public safety is at risk. One commenter said bank stabilization fills or structures that prevent the establishment of rooted vegetation should only be authorized in limited circumstances, specifically in areas with excessive and active shoreline erosion, areas with highly erodible soils, and shorelines exposed to frequent flux and wave action. This commenter also stated that hard bank stabilization structures should be limited to areas with critical public infrastructure where other bank stabilization approaches could not be done.

According to the National Oceanic and Atmospheric Administration's report entitled: "National Coastal Population Report: Population Trends from 1970 to 2020," 39 percent of the population of the United States (123.3 million people) lives in coastal shoreline counties. Approximately 52 percent of the nation's population lives in coastal watersheds (NOAA and U.S. Census Bureau 2013). That report defines "coastal shoreline counties" as counties that are "directly adjacent to the open ocean, major estuaries, and the Great Lakes." These coastal shoreline counties experience most of the direct effects of coastal hazards, and

therefore people living in these areas need bank stabilization activities to protect their property and infrastructure. As long as the entities responsible for land use planning and zoning (primarily local and state governments) continue to allow development in coastal areas, there will be a need for bank stabilization activities as people living in areas determine a need to take action to protect their property.

Although according to the study mentioned above (Gittman et al. 2015), an estimated 14 percent of coastal shoreline in the United States estimated has been altered by hard bank stabilization such as bulkheads, seawalls, jetties, and groins, it is important to consider how much of that hardened shoreline is located in coastal environments subject to higher energy erosive forces where bulkheads, seawalls, jetties, breakwaters, or revetments are necessary to control erosion and protect existing buildings and infrastructure. The percentage of shore estimated to be hardened by bank stabilization structures should also be considered in the overall context of the large number of people that live in coastal areas of the United States and the extensive proportion of land area in coastal zones that people have altered for their use. The 52 percent of the nation's population that lives in coastal watersheds has a large impact on the ecological condition of coastal waters because of the cumulative effects of human activities in those coastal zones. Those cumulative impacts to coastal ecosystems are caused by: pollution from land, rivers, and oceans; overharvesting fishery resources; habitat loss; species introductions; nutrient inputs; activities that reduce sediment inputs necessary to maintain coastal ecosystems; land use changes that convert coastal habitats such as forests, wetlands to urban, industrial, and recreational developments; the construction and operation of ports and other facilities; transportation projects; dredging; aquaculture activities; and shore protection structures (MEA 2005a). In summary, there are many other categories of activities in coastal areas besides bank stabilization activities that adversely affect coastal waters and their associated ecosystems and eliminate or diminish the ecological functions and services those waters and ecosystems provide.

Humans have long had substantial impacts on ecosystems and the ecological functions and services they provide (Ellis et al. 2010). Over 75 percent of the ice-free land on Earth has been altered by human occupation and use (Ellis and Ramankutty 2008). Approximately 33 percent of the Earth's ice-free land consists of lands heavily used by people: urban areas, villages, lands used to produce crops, and occupied rangelands (Ellis and Ramankutty 2008). Human population density is a good indicator of the relative effect that people have had on local ecosystems, with lower population densities causing smaller impacts to ecosystems and higher population densities having larger impacts on ecosystems (Ellis and Ramankutty 2008). According to NOAA and the U.S. Census Bureau (2013), in 2010 U.S. coastal shoreline counties had an average density of 446 people per square mile and U.S. coastal watershed counties had an average density of 319 people per square mile. Both of these densities are considered high population densities under the classification system used by Ellis and Ramankutty 2008). Human activities such as urbanization, agriculture, and forestry alter ecosystem structure and function by changing their interactions with other ecosystems, their biogeochemical cycles, and their species composition (Vitousek et al. 1997).

Given the relatively high percentage of the United States population that lives in coastal shoreline counties, and the fact that many coastal shoreline counties have been long been

significantly altered by human activities, the estimated percentage of hardened shoreline should be considered in the context of the cumulative impacts that have occurred in coastal shoreline counties or coastal watersheds. As explained above, there is a wide variety of activities that contribute to cumulative effects to coastal waters (also see MEA 2005b). Bank stabilization activities are a small subset of human activities that adversely affect coastal waters and wetlands.

It is also important to consider that a large number of waterfront property owners will want to protect their property with bank stabilization structures, such as bulkheads, seawalls, and revetments. Some waterfront property owners have taken different approaches (e.g., vegetative stabilization, bioengineering, living shorelines) to control erosion of their lands. Those landowners that perceive that erosion is not a problem will choose not to install any erosion control measures. Landowners will choose erosion control methods they believe will protect their property over a long term. They may have property fronted by tidal fringe wetlands that already protects their property. Gittman et al. (2015) estimated that only 1 percent of the United States coastline with tidal marsh has been armored by seawalls, bulkheads, revetments, or other hard structures, and those erosion control structures were often constructed landward of the tidal marsh. Gittman et al. (2015) does not indicate what proportion of those erosion control structures were constructed outside of the Corps' jurisdiction (e.g., landward of the high tide line and jurisdictional wetlands) and which proportion were authorized by DA permits, including NWPs. Areas defined by Gittman et al. (2015) as "sheltered shorelines" (i.e., shorelines located in bays, sounds, lagoons, or tidally influenced rivers) may not have site characteristics where living shorelines or vegetative stabilization might be appropriate and effective in controlling erosion. Some of these sheltered shorelines have larger fetches and be regularly exposed to higher energy waves and therefore require hard bank stabilization approaches to effectively protect coastal property and infrastructure. In general, living shorelines are limited to shores with gentle slopes and small fetches that are subject to low- to mid-energy waves

The entity responsible for managing a public beach is responsible for proposing an appropriate bank stabilization activity and the Corps will evaluate the proposal if it requires DA authorization. Bank stabilization measures are being used by people that want to protect their property, and by federal, tribal, state, and local governments as well as private entities that want to protect their infrastructure and other facilities. Vegetative stabilization is only effective in certain coastal areas where erosive forces (e.g., waves, currents, boat wakes) are low or moderate. The need to implement erosion control measures is a reaction to a perceived erosion problem that occurs after waterfront property has been developed. The responsibility for land use planning and zoning, including land use in coastal zones, generally falls on state and local governments.

We recognize that in coastal waters bulkheads, seawalls, and revetments have adverse effects on the structure, function, and dynamics of coastal ecosystems (e.g., Nordstrom et al. 2014; Gittman et al. 2016). We also recognize that other approaches to bank stabilization, such as living shorelines, also have some adverse effects on coastal ecosystems, such as habitat conversions (e.g., Bilkovic et al. 2016; Sutton-Grier et al. 2015). As discussed above, bank stabilization activities are not the only activities in coastal areas that adversely affect the structure, function, and dynamics of coastal waters and wetlands. The cumulative

effects of large number of people living in these coastal areas over the centuries has altered the structure, function, and dynamics of coastal ecosystems.

Three commenters said this NWP should be modified to increase its limits to encourage vegetative stabilization or bioengineering. Two commenters stated that they support the Corps' encouragement of bioengineering, but that there should be a limitation as to how much fill is authorized within a floodplain for bioengineered projects. Two commenters requested that NWP 13 clearly state that vegetative bank stabilization will not be required by the Corps at any particular site.

The NWP currently provides sufficient flexibility to landowners, public works agencies, and other entities to use a wide range of options to stabilize banks. The Corps does not regulate fills in floodplains unless there are discharges of dredged or fill material into waters of the United States. The Corps regulatory program does not regulate activities in floodplains per se; we only regulate activities in floodplains that require authorization under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899. Corps districts cannot mandate the use of a particular bank stabilization approach, such as vegetative stabilization, because district engineers can only provide advice on a landowner's proposed bank stabilization activity (see 33 CFR 320.4(g)(2)). The district engineer will evaluate the proposed activity, and if he or she determines the proposed activity will result in more than minimal adverse environmental effects, he or she will exercise discretionary authority and require an individual permit.

One commenter said that proposed paragraph (a) allows cumulative impacts to fish. Cumulative impacts to fish are caused not only by the placement of material into jurisdictional waters and wetlands to stabilize banks, but also by a wide variety of other activities that the Corps does not have the legal authority to regulate. Examples of other contributors to cumulative impacts to fish include: point source discharges of pollutants authorized by Clean Water Act section 402 permits, non-point sources of pollution, habitat loss and alterations that do not involve activities regulated by the Corps under its authorities, overharvesting of fish, climate change, land use/land cover changes in the watershed draining to the waterbodies inhabited by those fish, and resource extraction activities, such as water withdrawals.

Two commenters stated that the 500 linear foot limit is too high, and two commenters said the 500 linear foot limit should be removed because it is arbitrary. Another commenter said that the 500 linear foot limit encourages bank armoring. One commenter stated that the linear foot limit for bank stabilization by hard armoring should be 300 linear feet. Three commenters expressed concern that there is no linear foot limit for non-bioengineered bank stabilization projects and they recommend a limit of 500 linear feet for those projects. Two commenters recommended increasing the linear foot limit to 1,000 feet. One commenter stated that 500 linear foot bank stabilization activities should only be authorized by NWP on large rivers. One commenter said that a 500-foot bulkhead cannot have more than minimal adverse environmental effects. Another commenter remarked that NWP 13 activities should be limited to 300 linear feet in non-tidal waters inhabited by state or federally listed threatened or endangered freshwater mussel species. One commenter suggested changing the linear foot limits for stream bank stabilization authorized by NWP 13 to 500 linear feet

for hard armoring and 200 linear feet for scour protection.

The 500 linear foot limit was established to help ensure that NWP 13 activities result in no more than minimal individual and cumulative adverse environmental effects. Division engineers can modify this NWP through regional conditions to reduce the 500 linear foot limit if there are regional concerns regarding the potential for more than minimal adverse environmental effects to occur. The district engineer can waive the 500 linear foot limit on a case-by-case basis if he or she makes a written determination, after conducting agency coordination that the proposed activity will result in only minimal individual and cumulative adverse environmental effects. However, to address concerns about the adverse effects of bulkheads on coastal ecosystems, we have imposed a 1,000 linear foot limit on waivers for bulkheads. For proposed bulkheads that are 501 to 1,000 feet in length, district engineers can waive the 500 linear foot limit if they make written determinations after agency coordination that the proposed bulkheads will result in no more than minimal adverse environmental effects.

We are only applying the 1,000 linear foot cap to bulkheads because bulkheads have the potential, in some circumstances, to cause more severe adverse environmental effects than other bank stabilization techniques, such as bioengineering, vegetative stabilization, sills, rip rap, revetment, and stream barbs. Bulkheads constructed in estuaries cause losses of intertidal habitat through erosion caused by reflection of wave energy, changes in sediment transport, and inhibiting migration of the shoreline in response to sea level change (Dugan et al. 2011; Bilkovic and Mitchell 2013). In a recent meta-analysis, Gittman et al. (2016) found that species diversity and abundance near bulkheads are substantially lower compared to natural shorelines, and in general species diversity and abundance near shorelines protected by riprap or revetments do not differ from natural shorelines. Our decision to cap bulkheads at 1,000 linear feet is based on our experience and judgment to provide additional assurance that NWP 13 only authorizes those bank stabilization activities that have no more than minimal individual and cumulative adverse environmental effects. Project proponents that want to construct bulkheads longer than 1,000 linear feet along the shore can seek Department of the Army authorization by applying for an individual permit. Other bank stabilization techniques (e.g., bioengineering, vegetative stabilization, riprap) are not subject to this 1,000 linear foot cap, but for those proposed activities that exceed 500 linear feet in length along the shore, to be authorized by NWP 13 the district engineer must issue a written waiver of the 500 linear foot limit. That waiver must be based on a written determination made by the district engineer that the proposed activity results in only minimal adverse environmental effects.

The flexibility provided in the waiver process precludes the need to consider higher linear foot limits for this NWP. The 500 linear foot limit does not drive the decision whether the proposed bank stabilization activity should be a bulkhead or other hard structure; that is the decision of the landowner, public works department, or other responsible entity. The selected bank stabilization approach is mostly dependent on site conditions, and the likely effectiveness of that approach in controlling erosion. Any NWP 13 activity proposed by a non-federal permittee that might affect federally-listed endangered or threatened species or designated critical habitat, is in the vicinity of those listed species or critical habitat, or is located in critical habitat, requires a PCN (see paragraph (c) of general condition 18,

endangered species). For proposed NWP 13 activities that the district engineer determines "may affect" listed species or critical habitat, he or she will conduct formal or informal ESA section 7 consultation. Impacts to state-listed species are more appropriately addressed by state laws and regulations. The 500 linear foot limit should be the same for hardened stream bank stabilization and scour protection because they are both bank stabilization approaches.

Two commenters supported the proposed modification of paragraph (c) of this NWP, and recommended adding "or as needed for a stable maintainable side slope." Two commenters stated that NWP 13 should not authorize stabilization or fill placement below the ordinary high water mark or mean high water line. One commenter said that the one cubic yard per running foot limit is arbitrary and should be removed. Another commenter remarked that allowing discharges of one cubic yard per running foot for bulkheads below the ordinary high water mark or mean high water line frequently leads to scouring of the shore in front of the bulkhead. One commenter stated that this NWP should clarify that buried bank stabilization measures are not included in the quantity or length limits. One commenter suggested replacing the terms "high tide line" and "ordinary high water mark" in paragraph (c) with "high astronomical tide," except for the Great Lakes where "ordinary high water mark" would continue to be used.

We believe that the proposed text of paragraph (c) is sufficient to ensure that these activities result in no more than minimal adverse environmental effects. We do not believe it is necessary to add a requirement to establish a "stable maintainable side slope." If more than one cubic yard per running foot in waters of the United States is needed to make a suitable side slope, then the project proponent can request a waiver from the district engineer. Prohibiting discharges of dredged or fill material into waters of the United States below the ordinary high water mark or mean high water line would result in most bank stabilization activities requiring individual permits, even though they would have no more than minimal adverse environmental effects. If the bank stabilization activity is not properly integrated into the bottom of the waterbody, the bank stabilization activity is likely to collapse as erosion undercuts the bank stabilization measure.

The one cubic yard per running foot limit is intended to limit fills to ensure that NWP 13 activities result in only minimal adverse environmental effects. District engineers can issue written waivers of this one cubic yard per running foot limit, if they determine after conducting agency coordination that the proposed activity will result in no more than minimal individual and cumulative adverse environmental effects. In some situations, the placement of riprap at the bottom of the bulkhead is necessary to prevent scouring and undercutting of the bulkhead. Any discharges of dredged or fill material below the plane of the ordinary high water mark or high tide line are counted towards the one cubic yard per running foot limit, even if those fills are keyed into the bottom of the waterbody to reduce the potential for undercutting of the bank stabilization activity. The term "high tide line" is provided in the "Definitions" section of these NWPs (Section F), and is to be used for these NWPs, is identical to the definition at 33 CFR 328.3(d) that was published in the Corps' final rule issued on November 13, 1986 (51 FR 41251).

Two commenters said the placement of fill within special aquatic sites for bank stabilization should be prohibited. The placement of fill in special aquatic sites for the purposes of bank

stabilization can have no more than minimal adverse environmental effects. A proposed discharge of dredged or fill material into a special aquatic site requires the submission of a PCN to the district engineer and a request for a waiver of that prohibition. The district engineer will coordinate the PCN with the other agencies, in accordance with paragraph (d) of general condition 32. To waive that prohibition, the district engineer must issue a written waiver with a finding of no more than minimal adverse environmental effects. A waiver might require mitigation to ensure that the authorized activity results in no more than minimal adverse environmental effects.

One commenter supported the proposed modification stating that NWP 13 authorizes the maintenance and repair of existing bank stabilization features. A few commenters said this paragraph should be changed to limit maintenance and repair activities to previously authorized bank stabilization activities. One commenter objected to proposed paragraph (h), stating that it requires maintenance of a bank stabilization project in perpetuity. This commenter said the NWP should specify a period of time for the bank stabilization activity to become established.

We have concluded that it is not necessary to limit this provision to the maintenance and repair of previously authorized bank stabilization activities. Such a requirement would discourage the maintenance and repair of bank stabilization activities that have deteriorated over time and may be allowing sediments and other materials to enter the waterbody, adversely affecting water quality. In addition, there may be older bank stabilization activities that did not require DA authorization at the time they were constructed but changing environmental conditions makes their maintenance and repair subject to DA permit requirements. Paragraph (h) does not require a landowner or other entity to maintain a bank stabilization activity in perpetuity. The landowner or other entity also has the option of removing that bank stabilization activity and restoring the affected area to the extent practical. We do not believe it would be appropriate or practical to establish a period of time for a bank stabilization activity to become established because bioengineering or vegetative stabilization activities generally require more time than bulkheads or revetments. There are also a variety of other factors that affect the functional lifespan of a bank stabilization activity.

One commenter suggested adding timber mats to the paragraph authorizing temporary structures and fills, to minimize construction impacts. One commenter suggested that the word “promptly” be inserted before “removed” in the fourth sentence of this paragraph so that the temporary structures or fills are quickly removed after the work is completed.

We have added temporary mats, including timber mats, to this paragraph, consistent with the corresponding paragraphs proposed in NWPs 3 and 12. We do not agree that the word “promptly” should be added to that sentence because it may be necessary and environmentally beneficial to allow temporary fills to remain in place while the permanent fills settle and stabilize.

One commenter suggested allowing the use of non-native plants for bioengineering or vegetative bank stabilization in situations when native species are not as well-suited for a given project. Another commenter recommended adding “where practicable” to this

provision to allow for flexibility.

To make the requirement to use native plants more visible in the text of this NWP, we have moved it to a new paragraph (g). If native plants cannot be used for a bioengineering or vegetative bank stabilization activity, perhaps bioengineering or vegetative stabilization is not an appropriate option. There should be native plant species available for those activities. Contractors that rely on non-native plant species for their bioengineering or vegetative stabilization projects should seek sources of native plants that can serve those purposes.

Many commenters said that all NWP 13 activities should require PCNs. One commenter asserted that no NWP 13 activities should require PCNs. Some commenters stated that PCNs should be required for all NWP 13 activities involving bank or shoreline hardening. One commenter asserted that the terms and conditions of this NWP could not be enforced if PCNs are not required for all activities. Several commenters stated that the Corps could not track cumulative impacts unless PCNs are required for all activities. Some commenters remarked that the Corps could not ensure compliance with the Endangered Species Act or National Historic Preservation Act if PCNs are not required for all activities. Many commenters stated that if all proposed NWP B activities require PCNs, then all NWP 13 activities should require PCNs to provide more equivalency to those NWPs. Some of these commenters said that if not all NWP 13 activities require PCNs, then the NWP program would continue to have a bias towards bank stabilization activities that harden shorelines.

We do not believe that all NWP 13 activities, including all hard structures such as seawalls, bulkheads, revetments, and riprap, should require PCNs because they can often be constructed with only relatively small amounts of fill in jurisdictional waters. In shorelines or banks where there are strong erosive forces, hard bank stabilization structures are likely to be the only feasible options to protect property and infrastructure, and they will result in only minimal adverse environmental effects. The current PCN thresholds and the PCN requirements of certain general conditions (e.g., general condition 18, endangered species, and general condition 20, historic properties) are sufficient to ensure that NWP 13 activities result in no more than minimal individual and cumulative adverse environmental effects. Division engineers may modify this NWP to impose regional conditions that require PCNs for more activities authorized by this NWP. In our automated information system, we track NWP 13 activities that require PCNs as well as those NWP 13 activities where project proponents request NWP verifications even though they are not required to submit PCNs. Those reported activities, as well as estimates of NWP 13 activities that occurred without the requirement to submit PCNs, are considered in the Corps' cumulative effects analyses presented in the national decision document.

General condition 18, endangered species, requires non-federal permittees to submit PCNs for any proposed NWP activity that might affect ESA-listed species or designated critical habitat, is in the vicinity of listed species or designated critical habitat, or is in designated critical habitat. A similar requirement applies to general condition 20, historic properties. General condition 20 requires non-federal permittees to submit PCNs for any proposed NWP activity that may have the potential to cause effects to historic properties. If a non-federal project proponent does not comply with general conditions 18 and 20 and does not submit the required PCNs under the circumstances identified in paragraph (c) of those

general conditions, the activity is not authorized by NWP and is an unauthorized activity.

The PCN thresholds for NWPs 13 and the new NWP 54 (proposed NWP B) differ because the living shorelines authorized by NWP 54 typically involve greater amounts of fill into jurisdictional waters and wetlands, as well as fills and structures that typically extend a distance into subtidal or shallow waters. In other words, NWP 13 activities and NWP 54 activities, as a general rule, are not equivalent in terms of the amounts of fill that are typically discharged into jurisdictional waters and wetlands to conduct those activities, and the amount of encroachment into the waterbody. Nationwide permit 54 does not have a cubic yard limit on the amount of fill that can be discharged below the plane of the high tide line or ordinary high water mark. Bank stabilization activities authorized by NWP 13 often have small footprints in jurisdictional waters and wetlands and small encroachments into waterbodies because of the characteristics of the authorized activities. For example, seawalls and bulkheads that may be authorized by NWP 13 consist of vertical walls, perhaps with some backfilling behind the wall structure. Riprap, stone revetments, and gabions can be constructed close to the existing bank, with minor amounts of encroachment into the waterbody. Vegetative stabilization and bioengineering can also be constructed close to the existing bank with minimal encroachment into the waterbody. General condition 23, mitigation, requires the adverse effects of NWP activities to be avoided and minimized to the maximum extent practicable on the project site.

This NWP requires a PCN for any proposed activity that involves a discharge of dredged or fill material that exceeds an average of one cubic yard per running foot as measured along the length of the treated bank. The district engineer can waive this one cubic yard per running foot limit after conducting agency coordination under paragraph (d) of general condition 32 and making a written determination that the proposed activity will result in no more than minimal adverse environmental effects.

As discussed above, the activities authorized by new NWP 54 usually involve larger fills distributed over broader areas of waters to achieve the necessary marsh establishment area and/or molluscan reef structures to control erosion. If, instead of issuing a new NWP to authorize the construction and maintenance of living shorelines, we proposed to modify NWP 13 to authorize these activities, the vast majority of living shorelines would require PCNs and waivers of the one cubic yard per running foot limit. In addition, activities authorized by NWP 54 are more likely to encroach into state-owned lands in navigable waters that are held in trust for the benefit of the public. Because of those likely encroachments into navigable waters, NWP 54 construction activities will be reviewed on a case-by-case basis to ensure that those activities have no more than minimal adverse effects on navigation. Therefore, the activities typically authorized by NWPs 13 and 54 have some fundamental differences in fill quantities and encroachment into waters, and potential impacts to navigation and trust resources that warrant different PCN thresholds.

Many commenters said the 500 linear foot PCN threshold is too high, and the linear foot threshold should be reduced so that the Corps would be required to review more NWP 13 activities to make sure they result in no more than minimal adverse environmental effects. One commenter recommended requiring PCNs for any bank stabilization activity that requires mechanical equipment to be used in aquatic resources to construct that bank

stabilization activity.

We believe the 500 linear foot PCN threshold, as well as the other PCN thresholds, is sufficient to require PCNs for any proposed NWP 13 activity that might have the potential to result in more than minimal adverse environmental effects. Division engineers can modify this NWP on a regional basis to lower that PCN threshold by imposing regional conditions. By requiring more PCNs for NWP 13 activities, and thus more activity- and site-specific evaluations, division engineers can provide greater assurance that on a regional basis those activities will result in no more than minimal individual and cumulative adverse environmental effects.

In many circumstances, mechanical equipment used to construct or maintain bank stabilization activities authorized by NWP 13 can be operated from uplands or from barges or types of other work vessels to minimize their impacts on the aquatic environment. Division engineers can regionally condition this NWP to require PCNs for the use of mechanical equipment, if they have identified specific regional concerns regarding their use and its effect on aquatic resources. The current PCN thresholds, along with the additional PCNs required through regional conditions, are sufficient to ensure that NWP 13 activities result in no more than minimal individual and cumulative adverse environmental effects.

Several comments regarding the proposed PCN form were received, some of which addressed the proposed questions described in the June 1, 2016, proposed rule. One commenter suggested that questions relating to bank stabilization for the proposed PCN form should be addressed instead through general condition 32, pre-construction notification. Two commenters said that asking if there are qualified professionals in the area that construct living shorelines would discourage the use of living shorelines. One of these commenters suggested changing the question to directly ask whether a living shoreline can be used instead of a hardened bank stabilization activity. These two commenters also said that the term "qualified" needs to be defined and suggested that the question distinguish between the concepts of design and construction because one person might be qualified to construct a living shoreline but not to design it. One commenter said that it should not be necessary that the qualified consultant or engineer be a local person. One commenter stated that the Corps should provide information on methods for protecting and conserving shorelines, instead of asking the applicants through the PCN form.

The purpose of the information requirements in general condition 32 is to provide the district engineer with information on a specific proposed NWP activity, to help the district engineer determine whether the proposed activity qualifies for NWP authorization. The intent of the questions on the proposed PCN form is to gather information to inform future rulemaking efforts, not to evaluate specific NWP activities or potential alternatives. Comments on the proposed questions on the PCN form will be responded to in the documentation for the PCN form, if the form is approved. Alternatives analyses are not required for NWP PCNs. The suite of appropriate options for bank stabilization approach is highly site-specific. In addition, there are different approaches for living shorelines, so asking whether a living shoreline "could" be used will not provide much useful information. District engineers can only provide general information to landowners regarding bank stabilization options. District engineers cannot design a landowner's bank stabilization

activity. They can only evaluate the landowner's proposal to determine whether it qualifies for general permit authorization or whether an individual permit is required.

Two commenters stated that PCNs for NWP 13 should discuss whether the project site is in an area designated as suitable for living shoreline approaches based on a regional or state-level living shoreline analysis. They said that the Corps should consider the state's determination and apply it to the NWP verification decision. Another commenter said that NWP 13 PCNs should include a statement whether the proposed activity is consistent with regional policy and standards. Several commenters said that NWP 13 PCNs should include a statement explaining why a living shoreline is not appropriate for the project site, if a living shoreline is not being proposed.

If regional or state living shoreline analyses have been done, and those analyses are available to the public, then landowners can use those analyses to help evaluate bank stabilization options to protect their property. Because we are not establishing a preference for a particular approach to bank stabilization or erosion control, we do not believe that PCNs should require information on regional or state living shoreline analyses. If the state regulates shore erosion control activities, the state's regulations or permit decisions will influence or dictate the shore erosion approach proposed by the landowner. If that shore erosion activity requires DA authorization, then the state's regulations or permit decision will influence the landowner's permit application or PCN (if a PCN is required for an NWP activity). Living shorelines are feasible and effective in limited circumstances in coastal waters, so we do not agree that a statement regarding the appropriateness of living shorelines should be required as a standard statement in NWP 13 PCNs.

One commenter stated that, for proposed maintenance activities, the NWP 13 PCN should include evidence that the bank stabilization structure had been previously authorized. Several commenters said that project proponents submitting NWP 13 PCNs should clearly demonstrate that there are erosion risks, to justify the proposed bank stabilization activities. One commenter requested that NWP 13 PCNs include detailed information on the shoreline type and the status of adjacent properties, the water quality status of adjacent waters, a description of site conditions that demonstrate that it is necessary to do a bank stabilization activity rather than taking no action or constructing a living shoreline, and a written justification for proposing a hardened bank stabilization activity. Two commenters recommended using a public database for the collection of NWP 13 PCN information.

We do not believe it is necessary to demonstrate that the bank stabilization activity was previously authorized. It may have been authorized by a non-reporting NWP or other general permit and there might not be a written verification that shows what was previously authorized. It is also possible it did not require DA authorization at the time it was constructed. Erosion is a natural process. Therefore, wherever land and flowing water interact with each other, there will be erosion. Requiring permit applicants to demonstrate that erosion is occurring would not add value to the PCN process. In general, a landowner is not going to expend the time and expense to submit a PCN or hire a consultant or contractor to prepare a PCN and construct the bank stabilization activity if there is not an erosion problem at his or her property. Most landowners will only incur the expenses to construct bank stabilization activities if they believe that there is an erosion problem that needs to be

addressed.

Landowners or their consultants, when preparing PCNs for NWP 13 activities, may include information beyond the requirements of paragraph (b) of general condition 32, to assist the district engineer in his or her decision-making process. Such information can include the shoreline type and the types of bank stabilization (if any) already present at adjacent properties. The applicant may also describe site conditions to support his or her desired approach to bank stabilization (e.g., revetment, vegetative stabilization). The applicant does not need to demonstrate that a living shoreline is not practical or feasible at the site of the proposed NWP 13 activity, or provide a written justification for a hard bank stabilization approach. All NWP 13 verifications are tracked in our automated information system (ORM2), but that information is not publicly available on a web site. As discussed above, we will develop quarterly reports that show overall summary statistics pertaining to the use of each NWP, aggregated per Corps District, and display it on our website. Some statistics that may be reported regarding the NWPs may include number of verifications provided per quarter, acres of waters of the United States permanently lost, as well as including summary information on the use of waivers during the previous quarter. All data provided will be aggregated by NWP and all information on waivers will pertain only to those NWPs that include a waiver provision.

Several commenters stated that no waivers should be granted for NWP 13 activities. A number of commenters supported the waiver provisions for NWP 13. One commenter said that the use of waivers violates the Clean Water Act, and another commenter asserted that waivers allow more than minimal impacts to occur. One commenter stated that waivers should not be issued for bulkheads, revetments, and other bank hardening projects. A few commenters said there should be no caps on waivers.

We are retaining the proposed waiver provisions for NWP 13. Waivers are an important tool for providing flexibility in the NWP program, and for authorizing activities that have only minimal adverse environmental effects. Waivers also allow the Corps to focus its limited resources on proposed activities that require DA authorization and have substantial impacts on the aquatic environment. The use of waivers in the NWP program is not contrary to the Clean Water Act because all waivers require a written determination by the district engineer that the authorized NWP activity will have no more than minimal individual and cumulative adverse environmental effects, consistent with the requirements of section 404(e) of the Clean Water Act. No waiver of an NWP limit can occur without a written determination by the district engineer, and the issuance of an NWP verification letter by that district engineer. Waivers can be issued for bulkheads, revetments, and other hard bank stabilization activities that the district engineer determines will result in only minimal adverse environmental effects. All requests for waivers under NWP 13 will be coordinated with the appropriate resource agencies, in accordance with paragraph (d) of general condition 32, to assist with the district engineer's evaluation. We agree that there does not need to be caps on waivers because all waivers must be granted in writing by district engineers, after making a finding of "no more than minimal adverse environmental effects."

One commenter stated that no waivers should be granted to exceed the 500-foot limit. Another commenter said that waivers should not be granted for discharges of dredged or fill

material into special aquatic sites. One commenter stated that there should be no limit to waivers because most bank stabilization projects are beneficial to streams. One commenter recommended allowing waivers for fills in perennial streams. One commenter said that if an NWP 13 activity exceeds a limit, the applicant should be required to develop a restoration plan to address the causes of the erosion problem. A commenter stated that mitigation should be required for all waivers of the linear foot limit.

All requests for waivers of the 500 linear foot limit or the prohibition against discharges of dredged or fill material into special aquatic sites require site-specific evaluations by district engineers as well as agency coordination. The district engineer will evaluate the information in the PCN and comments received from the resource agencies before making his or her decision whether to grant the waiver. The waiver requires a written determination that the proposed activity will result in no more than minimal individual and cumulative adverse environmental effects. We agree that waivers may be appropriate to manage erosion in streams where streams may be impaired by excessive erosion, and the bank stabilization activity will result in no more than minimal adverse environmental effects. For NWP 13, waivers can be issued for bank stabilization activities in perennial streams. We do not agree that restoration (or any other form of compensatory mitigation) should be required for all NWP 13 activities requiring waivers. The district engineer will determine when compensatory mitigation should be required for a specific NWP activity, in accordance with 33 CFR 330.1(e)(3), to ensure that the authorized impacts are no more than minimal.

Several commenters suggested adding a provision to NWP 13 that requires a determination that the proposed bank stabilization activity is the least environmentally damaging practicable alternative because a living shoreline is not practicable because of site conditions such as excessive erosion, high energy conditions, excessive water depths, or navigation concerns. Many commenters expressed their position that NWP 13 must not be reissued because it violates the Clean Water Act. They said that proposed NWP B should be used in place of NWP 13. They assert that activities authorized by NWP 13 result in more than minimal individual and cumulative adverse environmental effects because hardened shorelines provide less habitat than natural shorelines. Two commenters stated that applicants requesting NWP 13 authorization for bulkheads need to demonstrate that a living shoreline is not feasible. One commenter suggested modifying NWP 13 to authorize living shorelines instead of proposed NWP B.

Activities authorized by NWP do not require a 404(b)(1) Guidelines alternatives analysis, including the identification of the least environmentally damaging practicable alternative (see 40 CFR 230.7(b)(1)). As discussed in its decision document, especially the 404(b)(1) Guidelines analysis, the reissuance of NWP 13 fully complies with the Clean Water Act. A decrease in the amount or quality of habitat along a shoreline does not necessarily mean that the adverse environmental effects are more than minimal, individual or cumulatively. Discharges of dredged or fill material into waters of the United States, and structures or work in navigable waters of the United States, for activities authorized by NWP 13 and NWP 54 will have no more than minimal adverse environmental effects as long as the project proponent complies with all applicable terms and conditions of these NWPs, including the PCN requirements. All forms of bank stabilization, including living shorelines, have some adverse environmental effects because they directly and indirectly

alter nearshore aquatic habitats, including animal and plant communities. As long as those adverse environmental effects are no more than minimal, they can be authorized by NWP. We do not agree that NWP 13 should include a requirement for the permittee to demonstrate that living shorelines are not feasible. Living shorelines are limited to coastal waters, including the Great Lakes, while NWP 13 activities can be conducted in a wide range of waters, from small streams to ocean waters. We believe that a separate NWP should be issued to authorize living shorelines, because of the limited circumstances in which living shorelines are an effective means of erosion control and the limited waters in which they can be used (i.e., shorelines in coastal waters with gentle slopes, low fetch, and low- to mid-energy waves).

One commenter stated that living shorelines are a practicable alternative to shoreline armoring because they are less expensive to construct and maintain. A number of commenters expressed the view that NWP 13 should establish a hierarchy for evaluating erosion control options to authorize the alternative that would result in the least environmentally damaging practicable alternative. Many commenters said that landowners should be allowed to select the bank stabilization technique used to protect their property from erosion, and that the final NWPs should not establish a preference for living shorelines over the bank stabilization techniques authorized by NWP 13. These commenters emphasized that landowners should be allowed to propose their preferred bank stabilization technique from a suite of available techniques.

We agree that, in certain circumstances, living shorelines are a feasible alternative to bulkheads, seawalls, and revetments. We also agree that landowners should be able to propose their preferred approach to bank stabilization, which may be based on guidance provided by any contractors or consultants they hire. Corps districts will evaluate the PCNs for proposed bank stabilization activities and determine whether they qualify for NWP authorization. We believe that it is not appropriate to establish a preference hierarchy for bank stabilization techniques because the appropriate bank stabilization approach for a particular site is highly dependent on site characteristics and the types of aquatic resources (e.g., streams, rivers, lakes, estuaries, oceans) in which the bank stabilization techniques will occur. In addition, there are regional differences among bank stabilization practices that cannot be addressed through a national rule such as the NWPs.

One commenter said that the requirements of general condition 3, spawning areas, when applied to NWP 13 activities would place an increased burden on road stabilization activities near tidal waters and may make those activities economically infeasible. Two commenters stated that bank armoring activities should require mitigation. One commenter said that undeveloped ocean shorelines should not be altered except when bank stabilization is justified to prevent or reduce threats to adjacent developed areas.

General condition 3 requires that NWP activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. The qualifier “to the maximum extent practicable” gives some flexibility to NWP 13 activities for roads near tidal waters that may need to be stabilized quickly to prevent them from eroding away. While there may be circumstances in which bank armoring activities warrant mitigation to ensure that the adverse environmental effects are no more than minimal, such decisions are made by the

district engineer after evaluating a PCN. We do not agree that mitigation should be required for all bank armoring activities authorized by NWP 13. If a parcel of land with an ocean shoreline is undeveloped, but one or both adjacent properties are developed (and may be protected by bank stabilization structures), the owner of the undeveloped parcel should be allowed to protect that bank if the bank will erode and the erosion is likely to encroach into the adjacent properties.

One commenter objected to the statement in the preamble to the proposed rule that said there are different PCN thresholds for NWPs 13 and 54 because living shorelines require substantial amounts of fill material. This commenter's objection was based on the assertion that living shorelines control erosion by planting vegetation or using a combination of vegetation and technical structures, not by the introduction of fill material.

For most living shorelines, it is necessary to discharge fill along the shoreline to achieve the proper grade for dissipating wave energy and protecting the bank from erosion and undercutting. These fills are planted with vegetation to hold the fill in place, and the plant stems also help dissipate wave energy. Sills, breakwaters, and other structures may also be necessary to reduce the energy of water reaching the shore to reduce erosion and protect fringe wetlands. If we had proposed to modify NWP 13 to authorize the construction and maintenance of living shorelines instead of proposing a new NWP, a large majority of proposed living shorelines would require PCNs. This is because they would exceed the cubic yard limit in paragraph (c) and require a written waiver from the district engineer because of the amount of fill required to provide the proper grade for wave energy dissipation and vegetation plantings, and stone sills or breakwaters or other fill structures. Under NWP 54, waivers are not required unless the proposed living shoreline impacts exceed the waivable limits in that NWP. One of the waivable limits in NWP 54 is for structures and fills encroaching into waters up to 30 feet from the mean low water line is not included in NWP 13 because of the differences between living shorelines and the forms of bank stabilization authorized by NWP 13.

The construction of living shorelines does have some adverse effects on the waters and special aquatic sites affected by these projects, including the organisms that inhabit those areas. Living shorelines do not produce the same degree of ecological functions and services as natural shorelines (Pilkey et al. 2012). With living shorelines, there are trade-offs in ecological functions and services as fills convert subtidal waters to intertidal waters. Under the 404(b)(1) Guidelines, discharges of dredged or fill material into waters of the United States are to be avoided and minimized to the maximum extent practicable (see also paragraph (a) of general condition 23, mitigation).

One commenter stated that this NWP should have conditions requiring final bank elevations to be no higher than the bank that existed prior to the bank stabilization activity. This commenter said that a floodway analysis should be conducted to demonstrate that there would be no increase in flood elevation as a result of the bank stabilization activity. Two commenters recommended adding provisions to this NWP that require the use of best management practices to minimize downstream impacts, such as instream sediment booms and oil booms. One commenter stated that there should be restrictions imposed on bank stabilization activities to protect forage fish spawning areas and critical habitat, channel

migration zones, and habitat for ESA-listed species.

District engineers, when evaluating PCNs, can impose activity-specific conditions regarding final bank elevations to be established at the site after the NWP 13 activity is completed. The requirement to conduct a floodway analysis is more appropriately addressed through state and local floodplain management authorities. Activities authorized by NWP 13 and other NWPs must comply with general condition 10, fills within 100-year floodplains. The use of best management practices to minimize downstream impacts is more appropriately addressed by district engineers through activity-specific conditions imposed on NWP authorizations, taking into account the site-specific characteristics of the proposed activity. General condition 3 requires measures to minimize adverse effects to fish spawning areas during spawning seasons. General condition 18, endangered species, establishes procedures for complying with the requirements of section 7 of the Endangered Species Act (ESA). District engineers will conduct ESA section 7 consultations for any proposed NWP 13 activities that they determine, after reviewing PCNs, may affect listed species or designated critical habitat.

Several commenters objected to the following sentence, which appeared in the preamble to the proposed rule (81 FR 35200): "Many landowners prefer bulkheads and revetments because well-constructed bulkheads last approximately 20 years and revetments can last up to 50 years (NRC 2007)." These commenters said this statement was not a conclusion of the committee that wrote the 2007 NRC report entitled "Mitigating Shore Erosion along Sheltered Coasts." These commenters asserted that the 2007 NRC report concluded that prior regulatory practices and local marine contractors are the main reason why landowners choose bulkheads and revetments. They said that in many cases landowners are not informed that there are other alternatives to erosion control. These commenters also expressed the opinion that the decisions of landowners are not driven by the lifespans of bulkheads and revetments. They said that it is a lack of understanding of alternative approaches to shore protection and institutional bias that causes the continued use of seawalls, bulkheads, and revetments.

The sentence on page 35,200 of the proposed rule should have been written as follows, to avoid misrepresenting the 2007 NRC report: "Well-constructed bulkheads last approximately 20 years and revetments can last up to 50 years (NRC 2007). Many landowners may prefer bulkheads and revetments because of the longevity of those structural measures to control erosion and protect their properties."

The section of the 2007 NRC report (pages 73-76) that discusses landowner options for addressing bank erosion presents a number of hypothetical scenarios to illustrate those options. If the life expectancies of bulkheads or stone revetments are irrelevant to the landowner's decision-making process, why were those life expectancies discussed in the bulkhead or stone revetment options? That section of the 2007 NRC report provides no information on how long marsh plantings or marsh plantings combined with stone sills will effectively control erosion, other than to say that a planted marsh fringe will require on-going maintenance and some maintenance will likely be required for the stone sill and marsh plantings after they are exposed to storm events. The landowner is a critical part of the decision-making process, because his or her property is at risk. Some landowners prefer

bulkheads and revetments because they make them feel more secure (Popkin 2015). It should be noted that in response to the proposal to issue a new NWP to authorize the construction and maintenance of living shorelines, we received many comments opposing the issuance of the new NWP 54. Many of those commenters expressed concern that they would be required to use living shorelines, instead of being able to use other approaches to erosion control.

In many coastal areas, hard bank stabilization measures are the only effective option in coastal environments where high energy erosive forces are present. A landowner may prefer a bank stabilization approach that he or she views as being more durable and requires less maintenance. Current regulatory frameworks and contractor preferences are only part of the decision-making process. The landowner makes the final decision unless the regulatory agency (federal, state, or local) decides to deny the landowner's permit application. Since the options (#2a and #2b) in that section of the 2007 NRC report include two living shoreline options, the report's discussion of the various options could be interpreted as including consideration of the expected longevities of those shore erosion control options, as well as their maintenance requirements. Living shorelines are relatively new, and there is much to be learned about their effectiveness over the long term, and in different areas of the country. As discussed above, many commenters stated that landowners and other entities should be allowed to choose how they protect their waterfront properties and their infrastructure. Those comments indicate that landowners are informed about various erosion control approaches and are not passively deferring to the contractors and consultants they hire to provide advice, design, and planning services, and to construct the authorized activities.

One commenter said that due to the increasing risks and costs of protecting ocean shorelines, applicants should be required to share substantially in the costs and responsibilities of implementing shoreline stabilization projects authorized by NWP 13. One commenter stated that the Corps needs to provide advance and meaningful notice to tribes to avoid unresolved impacts to tribal treaty natural resources and cultural resources. A couple of commenters asked how the Corps will enforce the terms and conditions of NWP 13 for bank stabilization activities. One commenter stated that the proposed changes to NWP 13 will cause an unfair burden to local agencies when they try to determine whether bank stabilization projects are authorized and whether pre-construction notification is required.

Landowners pay for the bank stabilization activities authorized by NWP 13 that they construct to protect their property. For the 2017 NWPs, the Corps districts consulted with interested tribes to identify regional conditions to protect tribal resources, including natural and cultural resources retained by, or reserved by or for, tribes through treaties. District engineers can also establish coordination procedures with interested tribes to coordinate proposed NWP 13 activities to help ensure that these activities do not cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands. Corps districts will enforce NWP 13 activities in the same manner as they enforce all individual permits and general permit authorizations, which is through the procedures described in the Corps' regulations at 33 CFR part 326 and relevant guidance and policy documents. Local agencies that are unsure whether their proposed bank stabilization activities qualify for NWP 13 authorization are encouraged to contact the

appropriate Corps district to seek their advice on whether the proposed activity might qualify for NWP 13 or a different general permit or whether an individual permit would be needed.

One commenter requested that the Corps evaluate regional impacts to local governments caused by division engineers adding regional conditions to this NWP and lengthening the time it takes to receive NWP verifications. Two commenters stated that NWP 13 activities should require a professional engineer's certification that the proposed bank stabilization activity will not exacerbate any upstream or downstream flooding problems.

Division engineers impose regional conditions on the NWPs to ensure that those NWPs comply with section 404(e) of the Clean Water Act and that authorized activities result in no more than minimal individual and cumulative adverse environmental effects. The regional conditioning process is a key tool for addressing regional differences in aquatic resources, as well as the ecological functions and services they provide. Regional conditions also facilitate compliance with other federal laws, such as section 7 of the Endangered Species Act and section 106 of the National Historic Preservation Act, as well as the Corps' tribal trust responsibilities. District engineers are required to respond to NWP PCNs within 45 days of receipt of a complete PCN, regardless of whether division engineers have imposed regional conditions on the NWPs. There are some exceptions to the 45-day response requirement, such as PCNs that require ESA section 7 and/or NHPA section 106 consultations and PCNs for activities authorized by NWPs 21, 49, and 50. Establishing requirements for a professional engineer's certification of bank stabilization activities and effects on upstream and downstream flooding are more appropriately addressed by state and local governments that have the authority to manage flooding risks. The Corps Regulatory Program does not have this authority.

Two commenters said that an environmental impact statement must be prepared for the reissuance of NWP 13. One commenter said that the reissuance of NWP 13 requires an environmental impact statement because of impacts to ESA-listed species. One commenter stated that the draft decision document failed to take into account the direct, indirect, and cumulative effects of NWP 13 activities. A few commenters asserted that the reissuance of NWP 13 requires ESA section 7 consultation.

For the reissuance of this NWP, Corps Headquarters complied with the requirements of the National Environmental Policy Act (NEPA) by preparing an environmental assessment with a finding of no significant impact. The environmental assessment describes, in general terms, the mitigation measures (including the requirements of NWP general conditions) that ensure that activities authorized by NWP result in no more than minimal individual and cumulative adverse environmental effects. Certain NWP 13 activities require pre-construction notification, another mechanism that helps ensure that NWP activities cause no more than minimal adverse environmental effects. The national decision document also generally describes compensatory mitigation practices that may be required by district engineers for specific NWP activities to ensure that those activities have no more than minimal adverse environmental effects. Compliance with the requirements in 33 CFR part 332, and activity-specific compensatory mitigation requirements, will help ensure that compensatory mitigation required by district engineers will offset the authorized impacts to

jurisdictional waters and wetlands.

The decision document prepared for this NWP describes, in general, the direct, indirect, and cumulative impacts of these activities. The direct and indirect effects caused by NWP 13 activities are described throughout the decision document. These direct and indirect effects are described in general terms because the decision to reissue this NWP is made prior to the NWP going into effect and authorizing specific activities at specific project sites. We prepared a NEPA cumulative effects analysis based on the Council on Environmental Quality's definition of "cumulative impact" at 40 CFR 1508.7, as well as a 404(b)(1) Guidelines cumulative effects analysis based on the requirements of 40 CFR 230.7(b)(3).

The decision document issued by Corps Headquarters discusses compliance with section 7 of the ESA, including the "no effect" determination Corps Headquarters made for the reissuance of this NWP. Our "no effect" determination is also presented in this final rule. The decision document discusses the processes and tools that the Corps uses to comply with ESA section 7, to ensure that this NWP is not likely to jeopardize the continued existence of listed species, or adversely modify or destroy critical habitat that has been designated for those listed species. The reissuance of NWP 13 has "no effect" on listed species or critical habitat because of the requirements of general condition 18, endangered species, and 33 CFR 330.4(f). For any proposed NWP activity that might affect listed species or designated critical habitat, is in the vicinity of listed species or designated critical habitat, or is located in designated critical habitat, the project proponent must submit a PCN, and the district engineer will evaluate that PCN to determine whether ESA section 7 consultation is required. If the district engineer makes a "may affect" determination for a proposed NWP activity, that activity is not authorized by NWP until after ESA section 7 consultation is completed.

The Corps has determined that the reissuance of this NWP does not result in a significant impact on the human environment that warrants the preparation of an environmental impact statement. This is because of the various protections in the NWP program that are applied to ESA-listed species and designated critical habitat and the fact that an NWP can only authorize activities that have no more than minimal adverse environmental effects.

A few commenters said that the proposed reissuance of NWP 13 is contrary to Executive Order 13653, Preparing the United States for the Impacts of Climate Change, which requires federal agencies to consider the challenges that climate change add to their programs, policies, rules, and operations, to ensure that those items continue to be effective as the climate changes. These commenters also stated that the Corps failed to consider the October 7, 2015, Presidential Memorandum entitled "Incorporating Natural Infrastructure and Ecosystem Services in Federal Decision-Making." These commenters indicated that the proposed rule also did not consider current Corps policies concerning climate change and sea level rise.

The activities authorized by NWP 13 are an important tool for landowners and communities to adapt to the effects caused by climate change, especially sea level rise and increases in the frequency of severe storm events. As sea level changes at a particular site, the landowner may need to conduct new or modified bank stabilization activities to protect his or her

property. Nature-based infrastructure approaches such as living shorelines may not be feasible or effective in higher energy coastlines subject to sea level rise. Existing buildings and other infrastructure may prevent inland migration of wetlands (Enwright et al. 2016). Public works agencies and utility companies may need to use NWP 13 activities to protect roads and utility lines from damage caused by erosion. In sum, NWP 13 activities will help landowners, public agencies, and other respond to sea level rise and other effects of climate change. This NWP authorizes bank stabilization activities undertaken by private landowners, who are not subject to the policies the Corps developed for the federal water resource projects it designs and implements.

Several commenters said that the Corps, in its draft decision document, did not demonstrate that NWP 13 will result in no more than minimal impacts, because that draft decision document only provides an estimate of impacts that will be authorized over a 5-year period. They also stated that the draft decision document ignores cumulative impacts, fails to account for climate change, and fails to assess impacts on ESA-listed species. One commenter said that the cumulative impact analysis within the draft decision document is impermissibly narrow and improperly delegates the cumulative impact analysis to specific projects. This commenter stated that if the Corps cannot conduct an adequate cumulative impact at the national level, it should not reissue NWP 13. One commenter asserted that the draft decision document did not evaluate the secondary impacts of bulkheads, because secondary effects are not discussed anywhere in that document. One commenter stated that NWP 13 violates the 404(b)(1) Guidelines because it causes significant degradation of waters of the United States.

Because the NWPs are issued before they go into effect and will be used over the next five years (unless they are modified, suspended, or revoked before the expiration date) to authorize specific activities being conducted by project proponents, the estimate of permitted impacts is a forward-looking estimate. In addition, the approach used in the decision document is fully consistent with the requirements of the 404(b)(1) Guidelines at 40 CFR 230.7(b)(3). The decision document includes two cumulative effects analyses: one to satisfy the requirements of NEPA, using the definition of "cumulative impact" at 40 CFR 1508.7. The other cumulative effects analysis satisfies the requirements of the 404(b)(1) Guidelines at 40 CFR 230.7(b)(3). The final decision document has been revised to discuss climate change. The decision document also discusses compliance with the Endangered Species Act, as well as cumulative effects to ESA-listed species (see the NEPA cumulative effects analysis, which includes ESA-listed species as a one of the "resources of concern" discussed in that analysis).

The cumulative effects analyses in the decision document prepared by Corps Headquarters satisfies the requirements of NEPA and the 404(b)(1) Guidelines and does not defer the cumulative impact analyses to district engineers who evaluate PCNs for specific activities. When evaluating an NWP PCN or a voluntary request for NWP verification, the district engineer will consider cumulative impacts when determining whether the proposed NWP activity will result in no more than minimal individual and cumulative adverse environmental effects. The district engineer's consideration of cumulative impacts does not need to be an extensive analysis because he or she is simply verifying whether NWP authorization is appropriate. The district engineer is not considering whether the issuance

of the NWP is appropriate, that is the decision that is being made by Corps Headquarters when it issues this rule, along with the more extensive cumulative effects analysis.

The draft decision document, as well as the final decision document, discusses in general terms the direct and indirect effects of NWP 13 activities on the environment. Secondary effects are analogous to indirect effects, and therefore do not warrant separate consideration in the decision document. The final decision document also concluded that the reissuance of this NWP complies with the 404(b)(1) Guidelines. Section 7.1.3 of the decision document discusses our determination that the reissuance of this NWP will not cause significant degradation of waters of the United States.

Three commenters expressed concern with the apparent overlap of authorization of bank stabilization projects using NWPs 13 and 27, and the proposed NWP B. These commenters pointed out that there are different limits for these NWPs and believe those differences encourage applicants to request authorization under the NWP that has the least restrictions or requirements. These commenters recommended clarifying the purposes of each of these NWPs so that project proponents apply for authorization under the most appropriate NWP. One commenter recommended that the NWPs provide incentives for landowners to retrofit existing seawalls with bioengineered methods. This commenter said that a streamlined process for retrofitting bank stabilization projects will encourage property owners to do these types of projects, instead of replacing an old seawall with a new seawall.

We have made changes to NWP 27 to limit it to aquatic habitat restoration, enhancement, and establishment activities so that it should no longer be used to authorize bank stabilization activities. We have also modified the definition of "living shoreline" in new NWP 54 to clarify that living shorelines are limited to coastal waters. We have also added a Note to NWP 54 to point prospective permittees to NWP 13 if they want to use an NWP to authorize vegetative stabilization activities or bioengineering activities in inland waters, such lakes other than the Great Lakes, and inland rivers and streams.

We cannot require landowners to retrofit existing seawalls with bioengineering, but landowners may propose to do those types of retrofits. Since we have clarified that NWP 13 authorizes bioengineering approaches to bank stabilization, in addition to seawalls, bulkheads, and revetments, project proponents may seek authorization for such retrofits through this NWP, if those retrofits require DA authorization.

Several commenters objected to the proposal to reissue NWP 13, stating that armoring shorelines with bulkheads and revetment prevent wetlands from migrating inland in response to sea level rise or land subsidence.

There are a number of reasons why coastal wetlands might not be able to migrate inland as sea level rises. Wetland migration may be impeded by natural and man-made impediments. Natural impediments include topography, such as steep coastal bluffs (Enwright et al. 2016). Man-made impediments include coastal urbanization and levees constructed to protect developed and agricultural areas (Enwright et al. 2016). Inland migration of wetlands is usually limited to undeveloped coasts and protected areas (e.g., wildlife refuges) with low, gentle slopes (Enwright et al. 2016). Other factors that affect inland wetland migration are:

erosion, subsidence, sedimentation, hydrologic alterations, water management. Inland migration in abandoned urban areas is likely to be limited to areas that have soil instead of asphalt or other hardened surfaces (Enwright et al. 2016). It should be noted that tidal wetlands have demonstrated strong resilience by being able to adjust to sea level rise by migrating vertically through accelerated soil buildup (Kirwan et al. 2016).

2.0 Alternatives

This evaluation includes an analysis of alternatives based on the requirements of NEPA, which requires a more expansive review than the Clean Water Act Section 404(b)(1) Guidelines. The alternatives discussed below are based on an analysis of the potential environmental impacts and impacts to the Corps, Federal, Tribal, and state resource agencies, general public, and prospective permittees. Since the consideration of off-site alternatives under the 404(b)(1) Guidelines does not apply to specific projects authorized by general permits, the alternatives analysis discussed below consists of a general NEPA alternatives analysis for the NWP.

2.1 No Action Alternative (No Nationwide Permit)

The no action alternative would not achieve one of the goals of the Corps Nationwide Permit Program, which is to reduce the regulatory burden on applicants for activities that result in no more than minimal individual and cumulative adverse environmental effects. The no action alternative would also reduce the Corps ability to pursue the current level of review for other activities that have greater adverse effects on the aquatic environment, including activities that require individual permits as a result of the Corps exercising its discretionary authority under the NWP program. The no action alternative would also reduce the Corps ability to conduct compliance actions.

If this NWP is not available, substantial additional resources would be required for the Corps to evaluate these minor activities through the individual permit process, and for the public and Federal, Tribal, and state resource agencies to review and comment on the large number of public notices for these activities. In a considerable majority of cases, when the Corps publishes public notices for proposed activities that result in no more than minimal adverse environmental effects, the Corps typically does not receive responses to these public notices from either the public or Federal, Tribal, and state resource agencies. Another important benefit of the NWP program that would not be achieved through the no action alternative is the incentive for project proponents to design their projects so that those activities meet the terms and conditions of an NWP. The Corps believes the NWPs have significantly reduced adverse effects to the aquatic environment because most applicants modify their projects to comply with the NWPs and avoid the delays and costs typically associated with the individual permit process.

In the absence of this NWP, Department of the Army (DA) authorization in the form of another general permit (i.e., regional or programmatic general permits, where available) or

individual permits would be required. Corps district offices may develop regional general permits if an NWP is not available, but this is an impractical and inefficient method for activities with only minimal individual and cumulative adverse environmental effects that are conducted across the Nation. Not all districts would develop these regional general permits for a variety of reasons. The regulated public, especially those companies that conduct activities in more than one Corps district, would be adversely affected by the widespread use of regional general permits because of the greater potential for lack of consistency and predictability in the authorization of similar activities with no more than minimal individual and cumulative adverse environmental effects. These companies would incur greater costs in their efforts to comply with different regional general permit requirements between Corps districts. Nevertheless, in some states Corps districts have issued programmatic general permits to take the place of this and other NWPs. However, this approach only works in states with regulatory programs comparable to the Corps Regulatory Program.

2.2 National Modification Alternatives

Since the Corps Nationwide Permit program began in 1977, the Corps has continuously strived to develop NWPs that only authorize activities that result in no more than minimal individual and cumulative adverse environmental effects. Every five years the Corps reevaluates the NWPs during the reissuance process, and may modify an NWP to address concerns for the aquatic environment. Utilizing collected data and institutional knowledge concerning activities authorized by the Corps regulatory program, the Corps reevaluates the potential impacts of activities authorized by NWPs. The Corps also uses substantive public comments on proposed NWPs to assess the expected impacts. This NWP was developed to authorize bank stabilization activities that have no more than minimal individual and cumulative adverse environmental effects. The Corps has considered suggested changes to the terms and conditions of this NWP, as well as modifying or adding NWP general conditions, as discussed in the preamble of the Federal Register notice announcing the reissuance of this NWP.

In the June 1, 2016, Federal Register notice, the Corps requested comments on the proposed reissuance of this NWP. The Corps proposed to modify this NWP by modifying the first paragraph of this NWP to clarify that it authorizes a wide variety of bank stabilization measures. In addition, the Corps proposed to modify paragraph (c) of this NWP to clarify that the quantity of the dredged or fill material discharged into waters of the United States must not exceed one cubic yard per running foot below the plane of the ordinary high water mark or the high tide line, as measured along the bank. The Corps also proposed to modify this NWP to authorize the maintenance of bank stabilization activities.

2.3 Regional Modification Alternatives

An important aspect for the NWPs is the emphasis on regional conditions to address differences in aquatic resource functions, services, and values across the nation. All Corps

divisions and districts are expected to add regional conditions to the NWPs to enhance protection of the aquatic environment and address local concerns. Division engineers can also revoke an NWP if the use of that NWP results in more than minimal individual and cumulative adverse environmental effects, especially in high value or rare wetlands and other waters. When an NWP is issued or reissued by the Corps, division engineers issue supplemental decision documents that evaluate potential impacts of the NWP at a regional level, and include regional cumulative effects assessments.

Corps divisions and districts also monitor and analyze the cumulative adverse effects of the NWPs, and if warranted, further restrict or prohibit the use of the NWPs to ensure that the NWPs do not authorize activities that result in more than minimal individual and cumulative adverse environmental effects. To the extent practicable, division and district engineers will use regulatory automated information systems and institutional knowledge about the typical adverse effects of activities authorized by NWPs, as well as substantive public comments, to assess the individual and cumulative adverse environmental effects resulting from regulated activities.

2.4 Case-specific On-site Alternatives

Although the terms and conditions for this NWP have been established at the national level to authorize most activities that have no more than minimal individual and cumulative adverse environmental effects, division and district engineers have the authority to impose case-specific special conditions on NWP authorizations to ensure that the authorized activities will result in only minimal individual and cumulative adverse environmental effects.

General condition 23 requires the permittee to minimize and avoid impacts to waters of the United States to the maximum extent practicable on the project site. Off-site alternatives cannot be considered for activities authorized by NWPs. During the evaluation of a pre-construction notification, the district engineer may determine that additional avoidance and minimization is appropriate and practicable. The district engineer may also condition the NWP authorization to require compensatory mitigation to offset losses of waters of the United States and ensure that the net adverse environmental effects are no more than minimal. As another example, the NWP authorization can be conditioned to prohibit the permittee from conducting the activity during specific times of the year to protect spawning fish and shellfish. If the proposed activity will result in more than minimal adverse environmental effects, then the district engineer will exercise discretionary authority and require an individual permit. Discretionary authority can be asserted where there are concerns for the aquatic environment, including high value aquatic habitats. The individual permit review process requires a project-specific alternatives analysis, including the consideration of off-site alternatives, and a public interest review.

3.0 Affected Environment

This environmental assessment is national in scope because the NWP may be used across the country, unless the NWP is revoked or suspended by a division or district engineer under the procedures in 33 CFR 330.5(c) and (d), respectively. The affected environment consists of terrestrial and aquatic ecosystems in the United States, as they have been directly and indirectly affected by past and present federal, non-federal, and private activities. The past and present activities include activities authorized by the various NWPs issued from 1977 to 2012, activities authorized by other types of Department of the Army (DA) permits, as well as other federal, tribal, state, and private activities that are not regulated by the Corps. Aquatic ecosystems are also influenced by past and present activities in uplands, because those land use/land cover changes in uplands and other activities in uplands have indirect effects on aquatic ecosystems (e.g., MEA 2005b, Reid 1993). Due to the large geographic scale of the affected environment (i.e., the entire United States), as well as the many past and present human activities that have shaped the affected environment, it is only practical to describe the affected environment in general terms. In addition, it is not possible to describe the environmental conditions for specific sites where the NWPs may be used to authorize eligible activities.

The total land area in the United States is approximately 2,264,000,000 acres, and the total land area in the contiguous United States is approximately 1,894,000,000 acres (Nickerson et al. 2011). Land uses in 48 states of the contiguous United States as of 2007 is provided in Table 3.1 (Nickerson et al. 2011). Of the land area in the entire United States, approximately 60 percent (1,350,000,000 acres) is privately owned (Nickerson et al. 2011). In the contiguous United States, approximately 67 percent of the land is privately owned, 31 percent is held by the United States government, and two percent is owned by state or local governments (Dale et al. 2000). Developed non-federal lands comprise 4.4 percent of the total land area of the contiguous United States (Dale et al. 2000).

Table 3.1. Major land uses in the United States (Nickerson et al. 2011).

Land Use	Acres	Percent of Total
Agriculture	1,161,000,000	51.3
Forest land	544,000,000	24.0
Transportation use	27,000,000	1.2
Recreation and wildlife areas	252,000,000	11.1
National defense areas	23,000,000	1.0
Urban land	61,000,000	2.7
Miscellaneous use	197,000,000	8.7
Total land area	2,264,000,000	100.0

3.1 Quantity of Aquatic Ecosystems in the United States

There are approximately 283.1 million acres of wetlands in the United States; 107.7 million

acres are in the conterminous United States and the remaining 175.4 million acres are in Alaska (Mitsch and Hernandez 2013). Wetlands occupy less than 9 percent of the global land area (Zedler and Kercher 2005). According to Dahl (2011), wetlands and deepwater habitats cover approximately 8 percent of the land area in the conterminous United States. Rivers and streams comprise approximately 0.52 percent of the total land area of the continental United States (Butman and Raymond 2011). Therefore, the wetlands, streams, rivers, and other aquatic habitats that are potentially waters of the United States and subject to regulation by the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899 comprise a minor proportion of the land area of the United States. The remaining land area of the United States (more than 92 percent, depending on the proportion of wetlands, streams, rivers, and other aquatic habitats that are subject to regulation under those two statutes) is outside the Corps regulatory authority.

Dahl (1990) estimated that approximately 53 percent of the wetlands in the conterminous United States were lost in the 200-year period from the 1780s to 1980s, while Alaska lost less than one percent of its wetlands and Hawaii lost approximately 12 percent of its original wetland acreage. In the 1780s, there were approximately 221 million acres of wetlands in the conterminous United States (Dahl 1990). California lost the largest percentage of its wetlands (91 percent), whereas Florida lost the largest acreage (9.3 million acres) (Dahl 1990). During that 200-year period, 22 states lost more than 50 percent of their wetland acreage, and 10 states have lost more than 70 percent of their original wetland acreage (Dahl 1990).

Frayer et al. (1983) evaluated wetland status and trends in the United States during the period of the mid-1950s to the mid-1970s. During that 20-year period, approximately 7.9 million acres of wetlands (4.2 percent) were lost in the conterminous United States. Much of the loss of estuarine emergent wetlands was due to changes to estuarine subtidal deepwater habitat, and some loss of estuarine emergent wetlands was due to urban development. For palustrine vegetated wetlands, nearly all of the losses of those wetlands were due to agricultural activities (e.g., conversion to agricultural production).

The U.S. Fish and Wildlife Service also examined the status and trends of wetlands in the United States during the period of the mid-1970s to the 1980s, and found that there was a net loss of more than 2.6 million acres of wetlands (2.5 percent) during that time period (Dahl and Johnson 1991). Freshwater wetlands comprised 98 percent of those wetland losses (Dahl and Johnson 1991). During that time period, losses of estuarine wetlands were estimated to be 71,000 acres, with most of that loss due to changes of emergent estuarine wetlands to open waters caused by shifting sediments (Dahl and Johnson 1991). Conversions of wetlands to agricultural use were responsible for 54 percent of the wetland losses, and conversion to other land uses resulted in the loss of 41 percent of wetlands (Dahl and Johnson 1991). Urban development was responsible for five percent of the wetland loss (Dahl and Johnson 1991). The annual rate of wetland loss has decreased substantially since the 1970s (Dahl 2011), when wetland regulation became more prevalent (Brinson and Malvárez 2002).

Between 2004 and 2009, there was no statistically significant difference in wetland acreage

in the conterminous United States (Dahl 2011). According to the 2011 wetland status and trends report, during the period of 2004 to 2009 urban development accounted for 11 percent of wetland losses (61,630 acres), rural development resulted in 12 percent of wetland losses (66,940 acres), silviculture accounted for 56 percent of wetland losses (307,340 acres), and wetland conversion to deepwater habitats caused 21 percent of the loss in wetland area (115,960 acres) (Dahl 2011). Some of the losses occurred to wetlands that are not subject to Clean Water Act jurisdiction and some losses are due to activities not regulated under Section 404 of the Clean Water Act, such as unregulated drainage activities, exempt forestry activities, or water withdrawals. From 2004 to 2009, approximately 100,020 acres of wetlands were gained as a result of wetland restoration and conservation programs on agricultural land (Dahl 2011). Another source of wetland gain is conversion of other uplands to wetlands, resulting in a gain of 389,600 acres during the period of 2004 to 2009 (Dahl 2011). Inventories of wetlands, streams, and other aquatic resources are incomplete because the techniques used for those studies cannot identify some of those resources (e.g., Dahl (2011) for wetlands; Meyer and Wallace (2001) for streams).

Losses of vegetated estuarine wetlands due to the direct effects of human activities have decreased significantly due to the requirements of Section 404 of the Clean Water Act and other laws and regulations (Dahl 2011). During the period of 2004 to 2009, less than one percent of estuarine emergent wetlands were lost as a direct result of human activities, while other factors such as sea level rise, land subsidence, storm events, erosion, and other ocean processes caused substantial losses of estuarine wetlands (Dahl 2011). The indirect effects of other human activities, such as oil and gas development, water extraction, development of the upper portions of watersheds, and levees, have also resulted in coastal wetland losses (Dahl 2011). Eutrophication of coastal waters can also cause losses of emergent estuarine wetlands, through changes in growth patterns of marsh plants and decreases in the stability of the wetland substrate, which changes those marshes to mud flats (Deegan et al. 2012).

The Emergency Wetlands Resources Act of 1986 (Public Law 99-645) requires the USFWS to submit wetland status and trends reports to Congress (Dahl 2011). The latest status and trends report, which covers the period of 2004 to 2009, is summarized in Table 3.2. The USFWS status and trends report only provides information on acreage of the various aquatic habitat categories and does not assess the quality or condition of those aquatic habitats (Dahl 2011).

Table 3.2. Estimated aquatic resource acreages in the conterminous United States in 2009 (Dahl 2011).

Aquatic Habitat Category	Estimated Area in 2009 (acres)
Marine intertidal	227,800
Estuarine intertidal non-vegetated	1,017,700
Estuarine intertidal vegetated	4,539,700
All intertidal waters and wetlands	5,785,200
Freshwater ponds	6,709,300
Freshwater vegetated	97,565,300
• Freshwater emergent wetlands	27,430,500
• Freshwater shrub wetlands	18,511,500
• Freshwater forested wetlands	51,623,300
All freshwater wetlands	104,274,600
Lacustrine deepwater habitats	16,859,600
Riverine deepwater habitats	7,510,500
Estuarine subtidal habitats	18,776,500
All wetlands and deepwater habitats	153,206,400

The acreage of lacustrine deepwater habitats does not include the open waters of Great Lakes (Dahl 2011).

The Federal Geographic Data Committee has established the Cowardin system developed by the U.S. Fish and Wildlife Service (USFWS) (Cowardin et al. 1979) as the national standard for wetland mapping, monitoring, and data reporting (Dahl 2011) (see Federal Geographic Data Committee (2013)). The Cowardin system is a hierarchical system which describes various wetland and deepwater habitats, using structural characteristics such as vegetation, substrate, and water regime as defining characteristics. Wetlands are defined by plant communities, soils, or inundation or flooding frequency. Deepwater habitats are permanently flooded areas located below the wetland boundary. In rivers and lakes, deepwater habitats are usually more than two meters deep. The Cowardin et al. (1979) definition of "wetland" differs from the definition used by the Corps and U.S. EPA for the purposes of implementing Section 404 of the Clean Water Act. The Corps-U.S. EPA regulations defines wetlands as "those areas that are inundated or saturated by surface or ground water 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." [33 CFR 328.3(c)(4); 40 CFR 230.3(o)(3)(iv)] The Cowardin et al. (1979) requires only one factor (i.e., wetland vegetation, soils, hydrology) to be present for an area to be a wetland, while the Corps-U.S. EPA wetland definition requires all three factors to be present under normal circumstances (Tiner 1997b, Mitsch and Gosselink 2015). The NWI produced by applying the Cowardin et al. (1979) definition is the only national scale wetland inventory

available. There is no national inventory of wetland acreage based on the Corps-U.S. EPA wetland definition at 33 CFR 328.3(c)(4).

There are five major systems in the Cowardin classification scheme: marine, estuarine, riverine, lacustrine, and palustrine (Cowardin et al. 1979). The marine system consists of open ocean on the continental shelf and its high energy coastlines. The estuarine system consists of tidal deepwater habitats and adjacent tidal wetlands that are usually partially enclosed by land, but may have open connections to open ocean waters. The riverine system generally consists of all wetland and deepwater habitats located within a river channel. The lacustrine system generally consists of wetland and deepwater habitats located within a topographic depression or dammed river channel, with a total area greater than 20 acres. The palustrine system generally includes all non-tidal wetlands and wetlands located in tidal areas with salinities less than 0.5 parts per thousand; it also includes ponds less than 20 acres in size. Approximately 95 percent of wetlands in the conterminous United States are freshwater wetlands, and the remaining 5 percent are estuarine or marine wetlands (Dahl 2011).

According to Hall et al. (1994), there are more than 204 million acres of wetlands and deepwater habitats in the State of Alaska, including approximately 174.7 million acres of wetlands. Wetlands and deepwater habitats comprise approximately 50.7 percent of the surface area in Alaska (Hall et al. 1994).

The National Resources Inventory (NRI) is a statistical survey conducted by the Natural Resources Conservation Service (NRCS) (USDA 2015) of natural resources on non-federal land in the United States. The NRCS defines non-federal land as privately owned lands, tribal and trust lands, and lands under the control of local and state governments. Acreages of palustrine and estuarine wetlands and the land uses those wetlands are subjected to are summarized in Table 3.3. The 2012 NRI estimates that there are 111,220,800 acres of palustrine and estuarine wetlands on non-Federal land and water areas in the United States (USDA 2015). The 2012 NRI estimates that there are 49,518,700 acres of open waters on non-Federal land in the United States, including lacustrine, riverine, and marine habitats, as well as estuarine deepwater habitats.

Table 3.3. The 2012 National Resources Inventory acreages for palustrine and estuarine wetlands on non-federal land, by land cover/use category (USDA 2015).

National Resources Inventory Land Cover/Use Category	Area of Palustrine and Estuarine Wetlands (acres)
cropland, pastureland, and Conservation Reserve Program land	17,800,000
forest land	65,800,000
rangeland	8,000,000
other rural land	14,700,000
developed land	1,400,000
water area	3,600,000
Total	111,300,000

The land cover/use categories used by the 2012 NRI are defined below (USDA 2015). Croplands are areas used to produce crops grown for harvest. Pastureland is land managed for livestock grazing, through the production of introduced forage plants. Conservation Reserve Program land is under a Conservation Reserve Program contract. Forest land is comprised of at least 10 percent single stem woody plant species that will be at least 13 feet tall at maturity. Rangeland is land on which plant cover consists mostly of native grasses, herbaceous plants, or shrubs suitable for grazing or browsing, and introduced forage plant species. Other rural land consists of farmsteads and other farm structures, field windbreaks, marshland, and barren land. Developed land is comprised of large urban and built-up areas (i.e., urban and built-up areas 10 acres or more in size), small built-up areas (i.e., developed lands 0.25 to 10 acres in size), and rural transportation land (e.g., roads, railroads, and associated rights-of-way outside urban and built-up areas). Water areas are comprised of waterbodies and streams that are permanent open waters.

The wetlands data from the Fish and Wildlife Service's Status and Trends study and the Natural Resources Conservation Service's National Resources Inventory should not be compared, because they use different methods and analyses to produce their results (Dahl 2011).

Leopold, Wolman, and Miller (1964) estimated that there are approximately 3,250,000 miles of river and stream channels in the United States. This estimate is based on an analysis of 1:24,000 scale topographic maps. Their estimate does not include many small streams. Many small streams, especially headwater streams, are not mapped on 1:24,000 scale U.S. Geological Survey (USGS) topographic maps (Leopold 1994) or included in other inventories (Meyer and Wallace 2001), including the National Hydrography Dataset (Elmore et al. 2013). Many small streams and rivers are not identified through maps produced by aerial photography or satellite imagery because of inadequate image resolution or trees or other vegetation obscuring the visibility of those streams from above (Benstead

and Leigh 2012). In a study of stream mapping in the southeastern United States, only 20 percent of the stream network was mapped on 1:24,000 scale topographic maps, and nearly none of the observed intermittent or ephemeral streams were indicated on those maps (Hansen 2001). Another study in Massachusetts showed that those types of topographic maps exclude over 27 percent of stream miles in a watershed (Brooks and Colburn 2011). For a 1:24,000 scale topographic map, the smallest tributary found by using 10-foot contour interval has a drainage area of 0.7 square mile and length of 1,500 feet, and smaller stream channels are common throughout the United States (Leopold 1994). Benstead and Leigh (2012) found that the density of stream channels (length of stream channels per unit area) identified by digital elevation models was three times greater than the drainage density calculated by using USGS maps. Elmore et al. (2013) made similar findings in watersheds in the mid-Atlantic, where they determined that the stream density was 2.5 times greater than the stream density calculated with the National Hydrography Dataset. Due to the difficulty in mapping small streams, there are no accurate estimates of the total number of river or stream miles in the conterminous United States that might be considered as "waters of the United States."

The quantity of the Nation's aquatic resources presented by studies that estimate the length or number of stream channels (see above) or the acreage of wetlands (USFWS status and trends studies, National Wetland Inventory (NWI), and Natural Resources Inventory (NRI) are underestimates, because those inventories do not include many small wetlands and streams. The USFWS status and trends study does not include Alaska, Hawaii, or the territories. The underestimate of national wetland acreage by the USFWS status and trends study and the NWI is primarily the result of the minimum size of wetlands detected through remote sensing techniques and the difficulty of identifying certain wetland types through those remote sensing techniques. The remote sensing approaches used by the USFWS for its NWI maps and its status and trends reports result in errors of omission that exclude wetlands that are difficult to identify through photointerpretation (Tiner 1997a). These errors of omission are due to wetland type and the size of target mapping units (Tiner 1997a). Therefore, it is important to understand the limitations of the source data when describing the environmental baseline for wetlands using maps and studies produced by remote sensing, especially in terms of wetland quantity.

Factors affecting the accuracy of wetland maps made by remote sensing include: the degree of difficulty in identifying a wetland, map scale, the quality and scale of the source information (e.g., aerial or satellite photos), the environmental conditions when the source information was obtained, the time of year source information was obtained, the mapping equipment, and the skills of the people producing the maps (Tiner 1999). The map scale usually affects the target mapping unit, which is the minimum wetland size that can be consistently mapped (Tiner 1997b). In general, wetland types that are difficult to identify through field investigations are likely to be underrepresented in maps made by remote sensing (Tiner 1999). Wetlands difficult to identify through remote sensing include forested wetlands, small wetlands, narrow wetlands, mowed wetlands, farmed wetlands, wetlands with hydrology at the drier end of the wetland hydrology continuum, and significantly drained wetlands (Tiner 1999). In the most recent wetland status and trends report published by the U.S. Fish and Wildlife Service, the target minimum wetland mapping unit was 1 acre,

although some easily identified wetlands as small as 0.1 acre were identified in that effort (Dahl 2011). The National Wetland Inventory identifies wetlands regardless of their jurisdictional status under the Clean Water Act (Tiner 1997b).

Activities authorized by NWPs will adversely affect a smaller proportion of the Nation's wetland base than indicated by the wetlands acreage estimates provided in the most recent status and trends report, or the NWI maps for a particular region.

Not all wetlands, streams, and other types of aquatic resources are subject to federal jurisdiction under the Clean Water Act (Mitsch and Gosselink 2015). Two U.S. Supreme Court decisions have identified limits to Clean Water Act jurisdiction. In 2001, in *Solid Waste Agency of Northern Cook County v. Army Corps of Engineers* (531 U.S. 159) the U.S. Supreme Court held that the use of isolated, non-navigable, intrastate waters by migratory birds is not, by itself a sufficient basis for exercising federal regulatory authority under the Clean Water Act (see 80 FR 37056). In the U.S. Supreme Court's 2006 decision in *Rapanos* v. *United States,* (547 U.S. 715), one justice stated that waters and wetlands regulated under the Clean Water Act must have a "significant nexus" to downstream traditional navigable waters. Four justices (the plurality) concluded that Clean Water Act jurisdiction applies only to relatively permanent waters connected to traditional navigable waters and to wetlands that have a continuous surface connection to those relatively permanent waters. The remaining justices in *Rapanos* stated that Clean Water Act jurisdiction applies to waters and wetlands that meet either the significant nexus test or the Plurality's test.

There are 94,133 miles of shoreline in the United States (NOAA 1975). Of that shoreline, 88,633 miles are tidal shoreline and 5,500 miles are shoreline along the Great Lakes and rivers that connect those lakes to the Atlantic Ocean. More recently, Gittman et al. (2015) estimated that there are 99,524 miles of tidal shoreline in the conterminous United States.

3.2 Quality of Aquatic Ecosystems in the United States

The USFWS status and trends study does not assess the condition or quality of wetlands and deepwater habitats (Dahl 2011). Information on water quality in waters and wetlands, as well as the causes of water quality impairment, is collected by the U.S. EPA under Sections 305(b) and 303(d) of the Clean Water Act. Table 3.4 provides U.S. EPA's most recent national summary of water quality in the Nation's waters and wetlands.

Table 3.4. National summary of water quality data (U.S. EPA 2015).

Category of water	Total waters	Total waters assessed	Percent of waters assessed	Good waters	Threatened waters	Impaired waters
Rivers and streams	3,533,205 miles	1,046,621 miles	29.6	476,765 miles	7,657 miles	562,198 miles
Lakes, reservoirs and ponds	41,666,049 acres	17,904,395 acres	43.0	5,658,789 acres	145,572 acres	12,100,034 acres
Bays and estuaries	87,791 square miles	33,402 square miles	38.0	7,291 square miles	0 square miles	26,111 square miles
Coastal shoreline	58,618 miles	8,162 miles	13.9	900 miles	0 miles	7,262 miles
Ocean and near coastal waters	54,120 square miles	1,674 square miles	3.1	616 square miles	0 square miles	1,058 square miles
Wetlands	107,700,000 acres	1,112,438 acres	1.0	573,947 acres	0 acres	538,492 acres
Great Lakes shoreline	5,202 miles	4,431 miles	85.2	78 miles	0 miles	4,353 miles
Great Lakes open waters	60,546 square miles	53,332 square miles	88.1	62 square miles	0 square miles	53,270 square miles

Waters and wetlands classified by states as “good” meets all their designated uses. Waters classified as “threatened” currently support all of their designated uses, but if pollution control measures are not taken one or more of those uses may become impaired in the future. A water or wetland is classified by the state as “impaired” if any one of its designated uses is not met. The definitions of good, threatened, and impaired are applied by states to describe the quality of their waters (the above definitions were found in the metadata in U.S. EPA (2015)). Designated uses include the “protection and propagation of fish, shellfish and wildlife,” “recreation in and on the water,” the use of waters for “public water supplies, propagation of fish, shellfish, wildlife, recreation in and on the water,” and “agricultural, industrial and other purposes including navigation.” (40 CFR 130.3). These designated uses are assessed by states in a variety of ways, by examining various physical, chemical and biological characteristics, so it is not possible to use the categories of “good,” “threatened,” and “impaired” to infer the level of ecological functions and services these waters perform.

According to the latest U.S. EPA national summary (U.S. EPA 2015), 54 percent of assessed rivers and streams, 68 percent of assessed lakes, reservoirs, and ponds, 78 percent of assessed bays and estuaries, 89 percent of assessed coastal shoreline, 63 percent of assessed ocean and near coastal waters, and 48 percent of assessed wetlands are impaired.

For rivers and streams, 34 causes of impairment were identified, and the top 10 causes were pathogens, sediment, nutrients, mercury, organic enrichment/oxygen depletion, polychlorinated biphenyls, metals (other than mercury), temperature, habitat alterations, and

flow alteration(s). The primary sources of impairment for the assessed rivers and streams were agriculture, unknown sources, atmospheric deposition, urban-related runoff/stormwater, hydromodification, municipal discharges/sewage, natural/wildlife, unspecified point source, habitat alterations not directly related to hydromodification, and resource extraction.

Thirty-one causes of impairment were identified for bays and estuaries. The top 10 causes of impairment for these waters is: mercury, polychlorinated biphenyls, pathogens, organic enrichment/oxygen depletion, dioxins, other causes, fish consumption advisories, metals (other than mercury), noxious aquatic plants, and pesticides. For bays and estuaries, the top 10 sources of impairment were atmospheric deposition, unknown sources, municipal discharges/sewage, other sources, industrial, natural/wildlife, urban-related runoff/stormwater, spills/dumping, unspecified non-point sources, and agriculture.

Coastal shorelines were impaired by 15 identified causes, the top 10 of which were: mercury, pathogens, organic enrichment/oxygen depletion, turbidity, pH/acidity/caustic conditions, nutrients, temperature, oil and grease, algal growth, and causes unknown/impaired biota. The top 10 sources of impairment of coastal shorelines are "unknown," atmospheric deposition, municipal discharges/sewage, urban-related runoff/ stormwater, hydromodification, unspecified non-point sources, agriculture, recreational boating and marinas, industrial, and spills/dumping.

For wetlands, 26 causes of impairment were identified, and the top 10 causes were organic enrichment/oxygen depletion, mercury, pathogens, metals (excluding mercury), toxic inorganics, temperature, sediment, algal growth, flow alterations, and turbidity. The primary sources for wetland impairment were "unknown," agriculture, atmospheric deposition, industrial, municipal discharges/sewage, recreational boating and marinas, resource extraction, natural/wildlife, hydromodification, and unspecified point sources.

Water quality standards are established by states, with review and approval by the U.S. EPA (see Section 303(c) of the Clean Water Act and the implementing regulations at 40 CFR part 131). Under Section 401 of the Clean Water Act States review proposed discharges to determine compliance with applicable water quality standards.

Most causes and sources of impairment are not due to activities regulated under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899. The indirect effects of changes in upland land use (which are not to be subject to federal control and responsibility, at least in terms of the Corps Regulatory Program), including the construction and expansion of upland developments, have substantial adverse effects on the quality (i.e. the ability to perform hydrologic, biogeochemical, and habitat functions) of jurisdictional waters and wetlands because those upland activities alter watershed-scale processes. Those watershed-scale processes include water movement and storage, erosion and sediment transport, and the transport of nutrients and other pollutants. Inputs of sediments into aquatic ecosystems can result from erosion occurring within a watershed (Beechie et al. 2013, Gosselink and Lee 1989). As water moves through a watershed it carries sediments and pollutants to streams (e.g., Allan 2004, Dudgeon et al. 2005, Paul and Meyer 2001) and

wetlands (e.g., Zedler and Kercher 2005, Wright et al. 2006). Non-point sources of pollution (i.e., pollutants carried in runoff from farms, roads, and urban areas) are largely uncontrolled (Brown and Froemke 2012) because the Clean Water Act only requires permits for point sources discharges of pollutants (i.e., discharges of dredged or fill material regulated under section 404 and point source discharges of other pollutants regulated under section 402).

Habitat alterations as a cause or source of impairment may be the result of activities regulated under section 404 and section 10 because they involve discharges of dredged or fill material into jurisdictional waters or structures or work in navigable waters, but habitat alterations may also occur as a result of activities not regulated under those two statutes, such as the removal of vegetation from upland riparian areas. Hydrologic modifications may or may not be regulated under section 404 or section 10, depending on whether those hydrologic modifications are the result of discharges of dredged or fill material into waters of the United States regulated under Section 404 of the Clean Water Act or structures or work in navigable waters of the United States regulated under Section 10 of the Rivers and Harbors Act of 1899. When states, tribes, or the U.S. EPA establish total daily maximum loads (TMDLs) for pollutants and other impairments for specific waters, there may be variations in how these TMDLs are defined (see 40 CFR part 130).

As discussed below, many anthropogenic activities and natural processes affect the ability of jurisdictional waters and wetlands to perform ecological functions. Stream and river functions are affected by activities occurring in their watersheds, including the indirect effects of land uses changes (Beechie et al. 2013, Allan 2004, Paul and Meyer 2001). Booth at al. (2004) found riparian land use in residential areas also strongly affects stream condition because many landowners clear vegetation up to the edge of the stream bank. The removal of vegetation from upland riparian areas and other activities in those non-jurisdictional areas do not require DA authorization.

Wetland functions are also affected by indirect effects of land use activities in the land area that drains to the wetland (Zedler and Kercher 2005, Wright et al. 2006). Human activities within a watershed or catchment that have direct or indirect adverse effects on rivers, streams, wetlands, and other aquatic ecosystems are not limited to discharges of dredged or fill material into waters of the United States or structures or work in a navigable waters. Human activities in uplands have substantial indirect effects on the structure and function of aquatic ecosystems, including streams and wetlands, and their ability to sustain populations of listed species. It is extremely difficult to distinguish between degradation of water quality caused by upland activities and degradation of water quality caused by the filling or alteration of wetlands (Gosselink and Lee 1989).

Most causes and sources of impairment are not due to activities regulated under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899. Habitat alterations as a cause or source of impairment may be the result of activities regulated under section 404 and section 10 because they involve discharges of dredged or fill material or structures or work in navigable waters, but habitat alterations may also occur as a result of activities not regulated under those two statutes, such as the removal of vegetation from

upland riparian areas. Hydrologic modifications may or may not be regulated under section 404 or section 10.

The U.S. Environmental Protection Agency (U.S. EPA) has undertaken the National Wetland Condition Assessment (NWCA), which is a statistical survey of wetland condition in the United States (U.S. EPA 2016). The NWCA assesses the ambient conditions of wetlands at the national and regional scales. The national scale encompasses the conterminous United States. The regional scale consists of four aggregated ecoregions: Coastal Plains, Eastern Mountains and Upper Midwest, Interior Plains, and West. In May 2016, U.S. EPA issued a final report on the results of its 2011 NWCA (U.S. EPA 2016).

The 2011 NWCA determined that, across the conterminous United States, 48 percent of wetland area (39.8 million acres) is in good condition, 20 percent of the wetland area (12.4 million acres) is in fair condition, and 32 percent (19.9 million acres) is in poor condition (U.S. EPA 2016). The 2011 NWCA also examined indicators of stress for the wetlands that were evaluated. The most prevalent physical stressors were vegetation removal, surface hardening via conversion to pavement or soil compaction, and ditching (U.S. EPA 2016). In terms of chemical stressors, most wetlands were subject to low exposure to heavy metals and soil phosphorous, but substantial percentages of wetland area in the West and Eastern Mountains and Upper Midwest ecoregions were found to have moderate stressor levels for heavy metals (U.S. EPA 2016). For soil phosphorous concentrations, stressor levels were high for 13 percent of the wetland area in the Eastern Mountains and Upper Midwest ecoregion (U.S. EPA 2016). Across the conterminous United States, for biological stressors indicated by non-native plants, 61 percent of the wetland area exhibited low stressor levels (U.S. EPA 2016). When examined on an ecoregion basis, the Eastern Mountains and Upper Midwest and Coastal Plains ecoregions had high percentages of wetland area with low non-native plant stressor levels, but the West and Interior Plains ecoregions had small percentages of areas with low non-native plant stressor levels (U.S. EPA 2016).

3.3 Aquatic resource functions and services

Functions are the physical, chemical, and biological processes that occur in ecosystems (33 CFR 332.2). Wetland functions occur through interactions of their physical, chemical, and biological features (Smith et al. 1995). Wetland functions depend on a number of factors, such as the movement of water through the wetland, landscape position, surrounding land uses, vegetation density within the wetland, geology, soils, water source, and wetland size (NRC 1995). In its evaluation of wetland compensatory mitigation in the Clean Water Act Section 404 permit program, the National Research Council (2001) recognized five general categories of wetland functions:

- Hydrologic functions
- Water quality improvement
- Vegetation support
- Habitat support for animals
- Soil functions

Hydrologic functions include short- and long-term water storage and the maintenance of wetland hydrology (NRC 1995). Water quality improvement functions encompass the transformation or cycling of nutrients, the retention, transformation, or removal of pollutants, and the retention of sediments (NRC 1995). Vegetation support functions include the maintenance of plant communities, which support various species of animals as well as economically important plants. Wetland soils support diverse communities of bacteria and fungi which are critical for biogeochemical processes, including nutrient cycling and pollutant removal and transformation (NRC 2001). Wetland soils also provide rooting media for plants, as well as nutrients and water for those plants. These various functions generally interact with each other, to influence overall wetland functioning, or ecological integrity (Smith et al. 1995, Fennessy et al. 2007). The Corps regulations at 33 CFR 320.4(b) list wetland functions that are important for the public interest review during evaluations of applications for DA permits, and for the issuance of general permits.

Not all wetlands perform the same functions, nor do they provide functions to the same degree (Smith et al. 1995). Therefore, it is necessary to account for individual and regional variation when evaluating wetlands and the functions and services they provide. The types and levels of functions performed by a wetland are dependent on its hydrologic regime, the plant species inhabiting the wetland, soil type, and the surrounding landscape, including the degree of human disturbance of the landscape (Smith et al. 1995).

Streams also provide a variety of functions, which differ from wetland functions. Streams also provide hydrologic functions, nutrient cycling functions, food web support, and corridors for movement of aquatic organisms (Allan and Castillo 2007). When considering stream functions, the stream channel should not be examined in isolation. The riparian corridor next to the stream channel is an integral part of the stream ecosystem and has critical roles in stream functions (NRC 2002). Riparian areas provide many of the same general functions as wetlands (NRC 1995, 2002). Fischenich (2006) conducted a review of stream and riparian corridor functions, and through a committee, identified five broad categories of stream functions:

- Stream system dynamics
- Hydrologic balance
- Sediment processes and character
- Biological support
- Chemical processes and landscape pathways

Stream system dynamics refers to the processes that affect the development and maintenance of the stream channel and riparian area over time, as well as energy management by the stream and riparian area. Hydrologic balance includes surface water storage processes, the exchange of surface and subsurface water, and the movement of water through the stream corridor. Sediment processes and character functions relate to processes for establishing and maintaining stream substrate and structure. Biological support functions include the biological communities inhabiting streams and their riparian areas. Chemical processes and pathway functions influence water and soil quality, as well as the chemical processes and nutrient cycles that occur in streams and their riparian areas. Rivers and streams function perform functions to different degrees, depending on watershed

condition, the severity of direct and indirect impacts to streams caused by human activities, and their interactions with other environmental components, such as their riparian areas (Allan 2004, Gergel et al. 2002).

Ecosystem services are the benefits that humans derive from ecosystem functions (33 CFR 332.2). The Millennium Ecosystem Assessment (2005b) describes four categories of ecosystem services: provisioning services, regulating services, cultural services, and supporting services. For wetlands and open waters, provisioning services include the production of food (e.g., fish, fruits, game), fresh water storage, food and fiber production, production of chemicals that can be used for medicine and other purposes, and supporting genetic diversity for resistance to disease. Regulating services relating to open waters and wetlands consist of climate regulation, control of hydrologic flows, water quality through the removal, retention, and recovery of nutrients and pollutants, erosion control, mitigating natural hazards such as floods, and providing habitat for pollinators. Cultural services that come from wetlands and open waters include spiritual and religious values, recreational opportunities, aesthetics, and education. Wetlands and open waters contribute supporting services such as soil formation, sediment retention, and nutrient cycling.

Examples of services provided by wetland functions include flood damage reduction, maintenance of populations of economically important fish and wildlife species, maintenance of water quality (NRC 1995, MEA 2005b) and the production of populations of wetland plant species that are economically important commodities, such as timber, fiber, and fuel (MEA 2005b). Wetlands can also provide important climate regulation and storm protection services (MEA 2005b).

Stream functions also result in ecosystem services that benefit society. Streams and their riparian areas store water, which can reduce downstream flooding and subsequent flood damage (NRC 2002, MEA 2005b). These ecosystems also maintain populations of economically important fish, wildlife, and plant species, including valuable fisheries (MEA 2005b, NRC 2002). The nutrient cycling and pollutant removal functions help maintain or improve water quality for surface waters (NRC 2002, MEA 2005b). Streams and riparian areas also provide important recreational opportunities. Rivers and streams also provide water for agricultural, industrial, and residential use (MEA 2005b).

Freshwater ecosystems provide services such as water for drinking, household uses, manufacturing, thermoelectric power generation, irrigation, and aquaculture; production of finfish, waterfowl, and shellfish; and non-extractive services, such as flood control, transportation, recreation (e.g., swimming and boating), pollution dilution, hydroelectric generation, wildlife habitat, soil fertilization, and enhancement of property values (Postel and Carpenter 1997).

Marine ecosystems provide a number of ecosystem services, including fish production; materials cycling (e.g., nitrogen, carbon, oxygen, phosphorous, and sulfur); transformation, detoxification, and sequestration of pollutants and wastes produced by humans; support of ocean-based recreation, tourism, and retirement industries; and coastal land development

and valuation, including aesthetics related to living near the ocean (Peterson and Lubchenco 1997).

Activities authorized by this NWP will provide a wide variety of services that are valued by society. For example, bank stabilization activities help protect property from erosion. Bank stabilization activities also help improve water quality by reducing sediment inputs into streams and other open waters. Bank stabilization activities cause losses of ecosystem services, and gains in some ecosystem services, but the overall level of ecosystem services provided in coastal areas occupied by erosion control features declines in comparison to the ecosystem services provided by natural ecosystems (NRC 2007). The importance of the ecosystem services resulting from bank stabilization activities is dependent on specific groups of stakeholders (NRC 2007).

4.0 Environmental Consequences

4.1 General Evaluation Criteria

This document contains a general assessment of the foreseeable effects of the individual activities authorized by this NWP and the anticipated cumulative effects of those activities. In the assessment of these individual and cumulative effects, the terms and limits of the NWP, pre-construction notification requirements, and the standard NWP general conditions are considered. The supplemental documentation provided by division engineers will address how regional conditions affect the individual and cumulative effects of the NWP.

The following evaluation comprises the NEPA analysis, the public interest review specified in 33 CFR 320.4(a)(1) and (2), and the impact analysis specified in Subparts C through F of the 404(b)(1) Guidelines (40 CFR Part 230).

The issuance of an NWP is based on a general assessment of the effects on public interest and environmental factors that are likely to occur as a result of using this NWP to authorize activities in waters of the United States. As such, this assessment must be speculative or predictive in general terms. Since NWPs authorize activities across the nation, projects eligible for NWP authorization may be constructed in a wide variety of environmental settings. Therefore, it is difficult to predict all of the indirect impacts that may be associated with each activity authorized by an NWP. For example, the NWP that authorizes 25 cubic yard discharges of dredged or fill material into waters of the United States may be used to fulfill a variety of project purposes, and the indirect effects will vary depending on the specific activity and the environmental characteristics of the site in which the activity takes place. Indication that a factor is not relevant to a particular NWP does not necessarily mean that the NWP would never have an effect on that factor, but that it is a factor not readily identified with the authorized activity. Factors may be relevant, but the adverse effects on the aquatic environment are negligible, such as the impacts of a boat ramp on water level fluctuations or flood hazards. Only the reasonably foreseeable direct, indirect, and cumulative effects are included in the environmental assessment for this NWP. Division

and district engineers will impose, as necessary, additional conditions on the NWP authorization or exercise discretionary authority to address locally important factors or to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects. In any case, adverse effects will be controlled by the terms, conditions, and additional provisions of the NWP. For example, Section 7 Endangered Species Act consultation will be required for all activities that may affect endangered or threatened species or critical habitat (see 33 CFR 330.4(f) and NWP general condition 18).

4.2 Impact Analysis

This NWP authorizes bank stabilization activities in all waters of the United States. There is a 500 linear foot limit for these activities, which can be waived by the district engineer on a case-by-case basis upon a determination that the bank stabilization will result in no more than minimal adverse effects on the environment and other public interest review factors. For bulkheads, the district engineer can waive the 500 linear foot limit up to 1,000 linear feet along the shore; if the length of the proposed bulkhead exceeds 1,000 linear feet along the shore the proposed bulkhead cannot be authorized by NWP 13. This 1,000 linear foot cap for bulkheads does not apply to other approaches to bank stabilization, such as bioengineering, vegetative stabilization, riprap, revetments, and stream barbs, but if those activities exceed 500 linear feet along the bank or shore, then to be authorized by NWP 13 a written waiver from the district engineer is required. Discharges of dredged or fill material for bank stabilization activities cannot exceed an average of one cubic yard per running foot, as measured along the length of the treated bank, below the plane of the ordinary high water mark or the high tide line, unless the district engineer waives this limit in writing after determining that the adverse effects on the environment and other public interest factors will be no more than minimal.

Pre-construction notification is required for: (1) discharges into special aquatic sites; or (2) activities in excess of 500 feet in length; or (3) activities involving discharges of greater than an average of one cubic yard per running foot as measured along the length of the treated bank, below the plane of the ordinary high water mark or the high tide line. The pre-construction notification requirement allows district engineers to review certain proposed NWP activities on a case-by-case basis to ensure that the individual and cumulative adverse environmental effects of those activities are no more than minimal. If the district engineer determines that the adverse environmental effects of a particular project are more than minimal after considering mitigation, then discretionary authority will be asserted and the applicant will be notified that another form of DA authorization, such as an individual permit or a regional general permit, is required (see 33 CFR 330.4(e) and 330.5).

When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type(s) of resource(s) that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP

activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. These criteria are listed in the NWPs in Section D, "District Engineer's Decision." If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

Additional conditions can be placed on proposed activities on a regional or case-by-case basis to ensure that the activities have no more than minimal individual and cumulative adverse environmental effects. Regional conditioning of this NWP will be used to account for differences in aquatic resource functions, services, and values across the country, ensure that the NWP authorizes only those activities with no more than minimal individual and cumulative adverse environmental effects, and allow each Corps district to prioritize its workload based on where its efforts will best serve to protect the aquatic environment. Regional conditions can prohibit the use of an NWP in certain waters (e.g., high value waters or specific types of wetlands or waters), lower pre-construction notification thresholds, or require pre-construction notification for some or all NWP activities in certain watersheds or types of waters. Specific NWPs can also be revoked on a geographic or watershed basis where the individual and cumulative adverse environmental effects resulting from the use of those NWPs are more than minimal.

In high value waters, division and district engineers can: 1) prohibit the use of the NWP in those waters and require an individual permit or regional general permit; 2) impose an acreage or linear foot limit on the NWP; 3) lower the pre-construction notification threshold of the NWP to require pre-construction notification for NWP activities with smaller impacts in those waters; 4) require pre-construction notification for some or all NWP activities in those waters; 5) add regional conditions to the NWP to ensure that the individual and cumulative adverse environmental effects are no more than minimal; or 6) for those NWP activities that require pre-construction notification, add special conditions to NWP authorizations, such as compensatory mitigation requirements, to ensure that the adverse environmental effects are no more than minimal. NWPs can authorize activities in high value waters as long as the individual and cumulative adverse environmental effects are no more than minimal.

The construction and use of structures and fills for temporary access for construction may be authorized by this NWP, NWP 33, or regional general permits issued by division or district engineers. The related activity must meet the terms and conditions of the specified permit(s). If the activity is dependent on portions of a larger project that require an individual permit, this NWP will not apply. [See 33 CFR 330.6(c) and (d)]

4.3 Cumulative Effects

4.3.1 General Analysis

The Council on Environmental Quality's (CEQ's) NEPA regulations define cumulative effects as: "the impact on the environment which results from the incremental impact 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. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." [40 CFR 1508.7.] Therefore, the NEPA cumulative effects analysis for an NWP is not limited to activities authorized by the NWP, other NWPs, or other DA permits (individual permits and regional general permits). The NEPA cumulative effects analysis must also include other Federal and non-Federal activities that affect the Nation's wetlands, streams, and other aquatic resources, as well as other resources (e.g., terrestrial ecosystems, air) that may be directly or indirectly affected by the proposed action and other actions. According to guidance issued by CEQ (1997), a NEPA cumulative effects analysis should focus on specific categories of resources (i.e., resources of concern) identified during the review process as having significant cumulative effects concerns. These cumulative effects analyses also require identification of the disturbances and stressors that cause degradation of those resources, including those caused by actions unrelated to the proposed action. A NEPA cumulative effects analysis does not need to analyze issues that have little relevance to the proposed action or the decision the agency will have to make (CEQ 1997).

The geographic scope of this cumulative effects analysis is the United States and its territories, where the NWP may be used to authorize specific activities that require DA authorization. The temporal scope of the cumulative effects analysis includes past federal, non-federal, and private actions that continue to affect the Nation's wetlands, streams, and other aquatic resources (including activities authorized by previously issued NWPs, regional general permits, and DA individual permits) as well as present and reasonably foreseeable future federal, non-federal, and private actions that are affecting, or will affect, wetlands, streams, and other aquatic resources. The present effects of past federal, non-federal, and private actions on wetlands, streams, and other aquatic resources are included in the affected environment, which is described in section 3.0. The affected environment described in section 3.0 also includes present effects of past actions, including activities authorized by NWPs issued from 1977 to 2012 and constructed by permittees, which are captured in national information on the quantity and quality of wetlands, streams, and other aquatic resources.

For coastal shorelines, Gittman et al. (2015) found that of the 99,524 of tidal shoreline in the conterminous United States, 14 percent of that shoreline was hardened by bulkheads, seawalls, revetments, breakwaters, groins, and jetties. Coastal areas with higher housing densities were more likely to have shorelines protected by bulkheads, seawalls, and revetments (Gittman et al. 2015). They also determined that approximately 1 percent of tidal marsh shoreline in the continental United States has hard protective structures constructed near the marsh (usually landward of the marsh) (Gittman et al. 2015). Not all of

these shore protection structures were authorized by DA permits, because bulkheads, seawalls, and other protective structures can be constructed landward of the Corps' jurisdiction so that they do not need DA authorization (NRC 2007).

The cumulative effects of bank stabilization activities are difficult to assess, and it is especially difficult to identify a threshold beyond which the cumulative effects are no longer acceptable to the various stakeholders in the assessment area (e.g., a bay, lake, river, or other type of geographic region) (NRC 2007). The cumulative effects of bank stabilization activities can be reduced if local governments restrict or prohibit development of coastal areas, thus reducing the need for shore erosion control activities (NRC 2007). Restricting or prohibiting development in these coastal areas through state or local government land use planning can reduce property losses due to erosion and other coastal hazards (NRC 2007).

In addition to the activities authorized by this NWP, there are many categories of activities that contribute to cumulative effects on wetlands, streams, and other aquatic resources in the United States, and alter the quantity of those resources, the functions they perform, and the ecosystem services they provide. Activities authorized by past versions of NWP 13, as well as other NWPs, individual permits, letters of permission, and regional general permits have resulted in direct and indirect impacts to wetlands, streams, and other aquatic resources. Those activities may have legacy effects that have added to the cumulative effects and affected the quantity of those resources and the functions they provide. Discharges of dredged or fill material that do not require DA permits because they are exempt from section 404 permit requirements can also adversely affect the quantity of the Nation's wetlands, streams, and other aquatic resources and the functions and services they provide. Discharges of dredged or fill material that convert wetlands, streams, and other aquatic resources to upland areas result in permanent losses of aquatic resource functions and services. Temporary fills and fills that do not convert waters or wetlands to dry land may cause short-term or partial losses of aquatic resource functions and services.

Humans have long had substantial impacts on ecosystems and the ecological functions and services they provide (Ellis et al. 2010). Around the beginning of the 19th century, the degree of impacts of human activities on the Earth's ecosystems began to exceed the degree of impacts to ecosystems caused by natural disturbances and variability (Steffen et al. 2007). All of the Earth's ecosystems have been affected either directly or indirectly by human activities (Vitousek et al. 1997). Over 75 percent of the ice-free land on Earth has been altered by human occupation and use (Ellis and Ramankutty 2008). Approximately 33 percent of the Earth's ice-free land consists of lands heavily used by people: urban areas, villages, lands used to produce crops, and occupied rangelands (Ellis and Ramankutty 2008). For marine ecosystems, Halpern et al. (2008) determined that there are no marine waters that are unaffected by human activities, and that 41 percent of the area of ocean waters are affected by multiple anthropogenic stressors (e.g., land use activities that generate pollution that go to coastal waters, marine habitat destruction or modification, and the extraction of resources). The marine waters most highly impacted by human activities are continental shelf and slope areas, which are affected by both land-based and ocean-based activities (Halpern et al. 2008). Human population density is a good indicator of the relative effect that people have had on local ecosystems, with lower population densities causing smaller

impacts to ecosystems and higher population densities having larger impacts on ecosystems (Ellis and Ramankutty 2008). Human activities such as urbanization, agriculture, and forestry alter ecosystem structure and function by changing their interactions with other ecosystems, their biogeochemical cycles, and their species composition (Vitousek et al. 1997). Changes in land use reduce the ability of ecosystems to produce ecosystem services, such as food production, reducing infectious diseases, and regulating climate and air quality (Foley et al. 2005).

Recent changes in climate have had substantial impacts on natural ecosystems and human communities (IPCC 2014). Climate change, both natural and anthropogenic, is a major driving force for changes in ecosystem structure, function, and dynamics (Millar and Brubaker 2006). However, there are other significant drivers of change to aquatic and terrestrial ecosystems. In addition to climate change, aquatic and terrestrial ecosystems are also adversely affected by land use and land cover changes, natural resource extraction (including water withdrawals), pollution, species introductions, and removals of species (Staudt et al. 2013, Bodkin 2012, MEA 2005d) and changes in nutrient cycling (Julius et al. 2013).

Cumulative effects to wetlands, streams, and other aquatic resources in the United States are not limited to the effects caused by activities regulated and authorized by the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Other federal, non-federal, and private activities also contribute to the cumulative effects to wetlands, streams, and other aquatic resources, by changing the quantity of those resources and the functions they provide. Wetlands, streams, and other aquatic resources and the functions and services they provide are directly and indirectly affected by changes in land use and land cover, alien species introductions, overexploitation of species, pollution, eutrophication due to excess nutrients, resource extraction including water withdrawals, climate change, and various natural disturbances (MEA 2005b). Freshwater ecosystems such as lakes, rivers, and streams are altered by changes to water flow, climate change, land use changes, additions of chemicals, resource extraction, and aquatic invasive species (Carpenter et al. 2011). Cumulative effects to wetlands, streams, and other aquatic resources are the result of landscape-level processes (Gosselink and Lee 1989). As discussed in more detail below, cumulative effects to aquatic resources are caused by a variety of activities (including activities that occur entirely in uplands) that take place within a landscape unit, such as the watershed for a river or stream (e.g., Allan 2004, Paul and Meyer 2001, Leopold 1968) or the contributing drainage area for a wetland (e.g., Wright et al. 2006, Brinson and Malvárez 2002, Zedler and Kercher 2005).

Cumulative effects also include environmental effects caused by reasonably foreseeable future actions that may take place after the permitted activity is completed. Such effects may include direct and indirect environmental effects caused by the operation and maintenance of the authorized structure or fill. For NWP 13, this includes environmental effects associated with the uses of the land that is protected by the bank stabilization activity authorized by this NWP, as well as the waters near the bank stabilization activity. In addition, a variety of pollutants might be released into the environment by residents and facilities constructed near the banks protected by these structures and fills. Those pollutants

may be discharged through either point sources or non-point sources and reach jurisdictional waters and wetlands. Point-source discharges would likely require National Pollutant Discharge Elimination System Permits under Section 402 of the Clean Water Act, which is administered by U.S. EPA or by states with approved programs. Pollutants may also be discharged through spills and other accidents. Land uses next to waterbodies may also have other direct and indirect effects on wetlands, streams, and other aquatic resources. The Corps does not have the authority to regulate reasonably foreseeable future activities that: (1) do not involved discharges of dredged or fill material into waters of the United States; (2) involve activities exempt from Clean Water Act Section 404 permit requirements under section 404(f); and (3) do not involve structures or work requiring DA authorization under Sections 9 or 10 of the Rivers and Harbors Act of 1899. Reasonably foreseeable future actions regulated by the Corps are considered during the evaluation process.

In a specific watershed, division or district engineers may determine that the cumulative adverse environmental effects of activities authorized by this NWP are more than minimal. Division and district engineers will conduct more detailed assessments for geographic areas that are determined to be potentially subject to more than minimal cumulative adverse environmental effects. Division and district engineers have the authority to require individual permits in watersheds or other geographic areas where the cumulative adverse environmental effects are determined to be more than minimal, or add conditions to the NWP either on a case-by-case or regional basis to require mitigation measures to ensure that the cumulative adverse environmental effects of these activities are no more than minimal. When a division or district engineer determines, using local or regional information, that a watershed or other geographic area is subject to more than minimal cumulative adverse environmental effects due to the use of this NWP, he or she will use the revocation and modification procedure at 33 CFR 330.5. In reaching the final decision, the division or district engineer will compile information on the cumulative adverse effects and supplement this document.

The Corps expects that the convenience and time savings associated with the use of this NWP will encourage applicants to design their projects within the scope of the NWP rather than request individual permits for projects which could result in greater adverse impacts to the aquatic environment. The minimization encouraged by the issuance of this NWP, as well as compensatory mitigation that may be required for specific activities authorized by this NWP, will help reduce cumulative effects to the Nation's wetlands, streams, and other aquatic resources.

Cumulative effects to specific categories of resources (i.e., resources of concern in accordance with CEQ's (1997) guidance) are discussed in more detail below. As discussed above, in addition to activities regulated under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899, there are many categories of activities that contribute to cumulative effects to the human environment. The activities authorized by this NWP during the 5-year period it will be in effect will result in no more than minimal incremental contributions to cumulative effects to these resource categories.

4.3.2 Cumulative Effects to Aquatic Ecosystems

The ecological condition of rivers and streams is dependent on the state of their watersheds (NRC 1992), because they are affected by activities that occur in those watersheds, including agriculture, urban development, deforestation, mining, water removal, flow alteration, and invasive species (Palmer et al. 2010). Land use changes affect rivers and streams through increased sedimentation, larger inputs of nutrients (e.g., nitrogen, phosphorous) and pollutants (e.g., heavy metals, synthetic chemicals, toxic organics), altered stream hydrology, the alteration or removal of riparian vegetation, and the reduction or elimination of inputs of large woody debris (Allan 2004). Agriculture is the primary cause of stream impairment, followed by urbanization (Foley et al. 2005, Paul and Meyer 2001). Agricultural land use adversely affects stream water quality, habitat, and biological communities (Allan 2004). Urbanization causes changes to stream hydrology (e.g., higher flood peaks, lower base flows), sediment supply and transport, water chemistry, and aquatic organisms (Paul and Meyer 2001). Leopold (1968) found that land use changes affect the hydrology of an area by altering stream flow patterns, total runoff, water quality, and stream structure. Changes in peak flow patterns and runoff affect stream channel stability. Stream water quality is adversely affected by increased inputs of sediments, nutrients, and pollutants, many of which come from non-point sources (Paul and Meyer 2001, Allan and Castillo 2007).

The construction and operation of water-powered mills in the 17th to 19th centuries substantially altered the structure and function of streams in the eastern United States (Walter and Merritts 2008) and those effects have persisted to the present time. In urbanized and agricultural watersheds, the number of small streams has been substantially reduced, in part by activities that occurred between the 19th and mid-20th centuries (Meyer and Wallace 2001). Activities that affect the quantity and quality of small streams include residential, commercial, and industrial development, mining, agricultural activities, forestry activities, and road construction (Meyer and Wallace 2001), even if those activities are located entirely in uplands.

Activities that affect wetland quantity and quality include: land use changes that alter local hydrology (including water withdrawal), clearing and draining wetlands, constructing levees that sever hydrologic connections between rivers and floodplain wetlands, constructing other obstructions to water flow (e.g., dams, locks), constructing water diversions, inputs of nutrients and contaminants, and fire suppression (Brinson and Malvárez 2002). Wetland loss and degradation is caused by hydrologic modifications of watersheds, drainage activities, logging, agricultural runoff, urban development, conversion to agriculture, aquifer depletion, river management, (e.g., channelization, navigation improvements, dams, weirs), oil and gas development activities, levee construction, peat mining, and wetland management activities (Mitsch and Hernandez 2013). Upland development adversely affects wetlands and reduces wetland functionality because those activities change surface water flows and alter wetland hydrology, contribute stormwater and associated sediments, nutrients, and pollutants, cause increases in invasive plant species abundance, and decrease the diversity of native plants and animals (Wright et al. 2006). Many of the remaining wetlands in the United States are degraded (Zedler and Kercher 2005). Wetland degradation and losses are caused by changes

in water movement and volume within a watershed or contributing drainage area, altered sediment transport, drainage, inputs of nutrients from non-point sources, water diversions, fill activities, excavation activities, invasion by non-native species, land subsidence, and pollutants (Zedler and Kercher 2005). According to Mitsch and Gosselink (2015), categories of activities that alter wetlands include: wetland conversion through drainage, dredging, and filling; hydrologic modifications that change wetland hydrology and hydrodynamics; highway construction and its effects on wetland hydrology; peat mining; waterfowl and wildlife management; agriculture and aquaculture activities; water quality enhancement activities; and flood control and stormwater protection.

There is also little national-level information on the ecological condition of the Nation's wetlands, streams, and other aquatic resources, or the amounts of functions they provide, although reviews have acknowledged that most of these resources are degraded (Zedler and Kercher 2005, Allan 2004) or impaired (U.S. EPA 2015) because of various activities, disturbances, and other stressors. These data deficiencies make it more difficult to characterize the affected environment to assess cumulative effects, and the relative contribution of the activities authorized by this NWP to those cumulative effects.

As discussed in section 3.0 of this document there is a wide variety of causes and sources of impairment of the Nation's rivers, streams, wetlands, lakes, estuarine waters, and marine waters (U.S. EPA 2015), which also contribute to cumulative effects to these aquatic resources. Many of those causes of impairment are point and non-point sources of pollutants that are not regulated under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899. Two common causes of impairment for rivers and streams, habitat alterations and flow alterations, may be due in part to activities regulated by the Corps under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899. Habitat and flow alterations may also be the caused by activities that do not involve discharges of dredged or fill material or structures or work in navigable waters. For wetlands, impairment due to habitat alterations, flow alterations, and hydrology modifications may involve activities regulated under section 404, but these causes of impairment may also be due to unregulated activities, such as changes in upland land use that affects the movement of water through a watershed or contributing drainage area or the removal of vegetation.

Many of the activities discussed in this cumulative effects section that affect wetlands, streams, and other aquatic resources are not subject to regulation under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899.

Estimates of the original acreage of wetlands in the United States vary widely because of the use of different definitions and how those estimates were made (Harris and Gosselink 1990). Dahl (1990) estimates that approximately 53 percent of the wetlands in the conterminous United States were lost in the 200-year period covering the 1780s to 1980s. Much of the wetland loss occurred in the mid-19th century as a result of indirect effects of beaver trapping and the removal of river snags, which substantially reduced the amount of land across the country that was inundated because of beaver dams and river obstructions (Harris and Gosselink 1990). The annual rate of wetland loss has decreased substantially since the

1970s (Dahl 2011), when wetland regulation became more prevalent (Brinson and Malvárez 2002). Between 2004 and 2009, there was no statistically significant difference in wetland acreage in the conterminous United States (Dahl 2011). According to the 2011 wetland status and trends report, during the period of 2004 to 2009 urban development accounted for 11 percent of wetland losses (61,630 acres), rural development resulted in 12 percent of wetland losses (66,940 acres), silviculture accounted for 56 percent of wetland losses (307,340 acres), and wetland conversion to deepwater habitats caused 21 percent of the loss in wetland area (115,960 acres) (Dahl 2011). Some of the losses occurred to wetlands that are not subject to Clean Water Act jurisdiction and some losses are due to activities not regulated under Section 404 of the Clean Water Act, such as unregulated drainage activities, exempt forestry activities, or water withdrawals. From 2004 to 2009, approximately 100,020 acres of wetlands were gained as a result of wetland restoration and conservation programs on agricultural land (Dahl 2011). Another source of wetland gain is conversion of other uplands to wetlands (389,600 acres during 2004 to 2009) (Dahl 2011). Inventories of wetlands, streams, and other aquatic resources are incomplete, especially at national or regional scales, because the techniques used for those inventories cannot identify all of those resources, especially small wetlands and streams (e.g., Dahl (2011) for wetlands; Meyer and Wallace (2001) for streams).

As discussed in section 3.0, national scale inventories of wetlands, streams, and other types of aquatic resources underestimate the quantity of those resources, and only general information is available on their ability to perform ecological functions and services. Therefore, it is not appropriate to make decisions concerning the significance of cumulative effects by calculating the relative proportion of the aquatic resources baseline impacted by a particular action, or a series of actions subject to a particular federal program. In addition, such an approach does not take into account the many categories of other activities that have direct and indirect effects on aquatic resources that are regulated under other federal, states, or local programs or are not regulated by any entity. Under the Council on Environmental Quality's NEPA definition at 40 CFR 1508.7, a cumulative effects analysis should instead examine the relative contribution that a proposed action will have on cumulative effects to one or more categories of natural resources (i.e., "the incremental impact of the action" and whether that incremental impact is significant or not significant).

For aquatic ecosystems, climate change affects water quality, biogeochemical cycling, and water storage (Julius et al. 2013). Climate change will also affect the abundance and distribution of wetlands across the United States, as well as the functions they provide (Mitsch and Gosselink 2015). Climate change results in increases in stream temperatures, more waterbodies with anoxic conditions, degradation of water quality, and increases in flood and drought frequencies (Julius et al. 2013). The increasing carbon dioxide concentration in the atmosphere also changes the pH of the oceans, resulting in ocean acidification (RS and NAS 2014), which adversely affects corals and some other marine organisms.

Compensatory mitigation required by district engineers for specific activities authorized by this NWP will help reduce the contribution of those activities to the cumulative effects on the Nation's wetlands, streams, and other aquatic resources, by providing ecological

functions to partially or fully replace some or all of the aquatic resource functions lost as a result of those activities. Compensatory mitigation requirements for the NWPs are described in general condition 23 and compensatory mitigation projects must also comply with the applicable provisions of 33 CFR part 332. District engineers will establish compensatory mitigation requirements on a case-by-case basis, after evaluating pre-construction notifications. Compensatory mitigation requirements for individual NWP activities will be specified through permit conditions added to NWP authorizations. When compensatory mitigation is required, the permittee is required to submit a mitigation plan prepared in accordance with the requirements of 33 CFR 332.4(c). Credits from approved mitigation banks or in-lieu fee programs may also be used to satisfy compensatory mitigation requirements for NWP authorizations. Monitoring is required to demonstrate whether the permittee-responsible mitigation project, mitigation bank, or in-lieu fee project is meeting its objectives and providing the intended aquatic resource structure and functions. If the compensatory mitigation project is not meeting its objectives, adaptive management will be required. Adaptive management may involve taking actions, such as site modifications, remediation, or design changes, to ensure the compensatory mitigation project meets its objectives (see 33 CFR 332.7(c)).

The estimated contribution of activities authorized by this NWP to the cumulative effects to wetlands, streams, and other aquatic resources in the United States during the five year period that the NWP would be in effect, in terms of the estimated number of time this NWP would be used until it expires and the projected impacts and compensatory mitigation, is provided in section 7.2.2. It is not practical or feasible to provide quantitative data on the multitude of other contributors to cumulative effects to these resources, including the federal, non-federal, and private activities that are not regulated by the Corps that will also occur during the five year period this NWP is in effect. National-level data on these many categories of activities that are not regulated by the Corps but contribute to cumulative effects are either not collected for the nation or they are not accessible. The activities authorized by this NWP will result in a minor incremental contribution to the cumulative effects to wetlands, streams, and other aquatic resources in the United States because, as discussed in this section, they are one category of many categories of activities that affect those aquatic resources. The causes of cumulative effects discussed in this section include past, present, and reasonably foreseeable future federal, non-federal, and private activities. For the national-scale cumulative effects analysis presented in this section, it is not possible to quantify the relative contributions of all of the various activities that affect the quantity of wetlands, streams, and other aquatic resources and the functions and services they provide, because such data are not available at the national scale.

As discussed above, there are many categories of activities not regulated by the Corps under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899 that contribute to cumulative effects to wetland, streams, and other aquatic resources. During the 5-year period this NWP is in effect, the activities it authorizes will result in only a no more than minimal incremental contribution to cumulative effects to wetlands, streams, and other aquatic ecosystems.

4.3.3 Cumulative Effects to Coastal Areas

In the United States, approximately 39 percent of its population lives in counties that are next to coastal waters, the territorial seas, or the Great Lakes (NOAA 2013). Those counties comprise less than 10 percent of the land area of the United States (NOAA 2013). Coastal waters are also affected by a wide variety of activities. The major drivers of changes to coastal areas are: development activities that alter coastal forests, wetlands, and coral reef habitats for aquaculture and the construction of urban areas, industrial facilities, and resort and port developments (MEA 2005d). Dredging, reclamation, shore protection and other structures (e.g., causeways and bridges), and some types of fishing activities also cause substantial changes to coastal areas (MEA 2005d). Nitrogen pollution to coastal zones change coral reef communities (MEA 2005d). Adverse effects to coastal waters are caused by habitat modifications, point source pollution, non-point source pollution, changes to hydrology and hydrodynamics, exploitation of coastal resources, introduction of non-native species, global climate change, shoreline erosion, and pathogens and toxins (NRC 1994).

Substantial alterations of coastal hydrology and hydrodynamics are caused by land use changes in watersheds draining to coastal waters, the channelization or damming of streams and rivers, water consumption, and water diversions (NRC 1994). Approximately 52 percent of the population of the United States lives in coastal watersheds (NOAA 2013). Eutrophication of coastal waters is caused by nutrients contributed by waste treatment systems, non-point sources, and the atmosphere, and may cause hypoxia or anoxia in coastal waters (NRC 1994). Changes in water movement through watersheds may also alter sediment delivery to coastal areas, which affects the sustainability of wetlands and intertidal habitats and the functions they provide (NRC 1994). Most inland waters in the United States drain to coastal areas, and therefore activities that occur in inland watersheds affect coastal waters (NRC 1994). Inland land uses, such as agriculture, urban development, and forestry, adversely affect coastal waters by diverting fresh water from estuaries and by acting as sources of nutrients and pollutants to coastal waters (MEA 2005d).

Coastal wetlands have been substantially altered by urban development and changes to the watersheds that drain to those wetlands (Mitsch and Hernandez 2013). Coastal habitat modifications are the result of dredging or filling coastal waters, inputs of sediment via non-point sources, changes in water quality, or alteration of coastal hydrodynamics (NRC 1994). Coastal development activities, including those that occur in uplands, affect marine and estuarine habitats (MEA 2005b). The introduction of non-native species may change the functions and structure of coastal wetlands and other habitats (MEA 2005b). Fishing activities may also modify coastal habitats by changing habitat structure and the biological communities that inhabit those areas (NRC 1994).

As discussed above, there are many categories of activities not regulated by the Corps under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899 that contribute to cumulative effects to coastal areas. During the 5-year period this NWP is in effect, the activities it authorizes will result in only a no more than minimal incremental contribution to cumulative effects to coastal areas.

4.3.4 Cumulative Effects to Endangered and Threatened Species

The status of species as threatened or endangered is also due to cumulative effects (NRC 1986, Odum 1982), and activities authorized by Department of the Army permits are a minor contributor to the cumulative effects to endangered and threatened species. Land use and land cover changes are the main cause of the loss of biodiversity (Vitousek et al. 1997). The decline of a species that leads to its status as endangered or threatened is usually caused by multiple factors rather than a single factor (Wilcove et al. 1998, Venter et al. 2006, Czech and Krausman 1997, Richter et al. 1997). It is difficult to determine the relative contribution of each cause of species decline or endangerment (Czech and Krausman 1997). For example, for fish species, the number of factors affecting their status ranged from 1 to 15, with an average of 4.5 threats. Over 40 percent of fish species were endangered or threatened as a result of 5 or more factors, and less than 7 percent of fish species were identified as imperiled because of a single factor. During the past few hundred years, human activities have increased species extinction rates by around 1,000 times the Earth's background extinction rates (MEA 2005c).

The main causes of the decline of species to endangered or threatened status are habitat loss and degradation, introduction of species, overexploitation, disease, and climate change (MEA 2005d). Habitat degradation also includes changes in habitat quality caused by habitat fragmentation and pollution. Habitat fragmentation can occur in rivers, and is characterized by disruption of a river's natural flow regime by dams, inter-basin water transfers, or water withdrawals and affects 90 percent of the world's river water volume (MEA 2005d). Invasive alien species are a major cause of species endangerment in freshwater habitats (MEA 2005d). Losses of biological diversity are directly caused by habitat modifications, including land use changes, alteration of river and stream flows, water withdrawals from rivers, losses of coral reefs, and alteration of the sea bed caused by trawling (MEA 2005c). Other direct causes of losses of biodiversity include pollution, invasive species, species overexploitation, climate change, and disease (MEA 2005c). There are often multiple factors interacting with each other to reduce biodiversity, instead of single factors working alone (MEA 2005c).

Wilcove et al. (1998) evaluated five categories of threats to species in the United States, and conducted further analyses on the types of habitat destruction that caused species to be listed as endangered or threatened under the Endangered Species Act. The five categories of threats were habitat destruction, alien species, overharvest, pollution, and disease. Wilcove et al. (1998) focused on species under the jurisdiction of the U.S. Fish and Wildlife Service. More than half of the endangered and threatened species under the jurisdiction of the NMFS were listed after this study was published. Wilcove et al. (1998) found information on the threats to 1,880 species, out of a total of 2,490 species that were categorized as imperiled at that time. Habitat destruction and degradation was the most comment threat, a factor for 85 percent of the imperiled species analyzed. The second most common threat was competition with non-native species, or predation by those species. For aquatic animal species, pollution was the second most common cause of endangerment, after habitat loss (Wilcove et al. 1998).

To more closely examine the causes of habitat loss, Wilcove et al. (1998) analyzed U.S. Fish and Wildlife endangered species listing documents and identified 14 categories of habitat loss or degradation: agriculture; livestock grazing; mining and oil and gas extraction; logging; infrastructure development; road construction and maintenance; military activities; outdoor recreation; use of off-road vehicles; water development projects (e.g., water diversions, flood control facilities; drainage projects; aquaculture; navigation); dams, impoundments, and other water barriers; pollutants (e.g., sediment and mining pollutants); residential and commercial developments; and disruption of fire ecology. Many species were subject to more than one cause of endangerment (Wilcove et al. 1998). Agriculture was the leading cause of habitat destruction, affecting 38 percent of endangered species, followed by residential and commercial development (35 percent), water development (30 percent), and infrastructure development (17 percent). Habitat destruction caused by water development affected 91 percent of listed fish species and 99 percent of listed mussel species.

Richter et al. (1997) studied the factors that endanger freshwater animals. The most significant threats to those species are habitat destruction, habitat fragmentation, pollution, and exotic species. Richter et al. (1997) also looked at the stressors that are impeding the recovery of aquatic species at risk of extinction and found that changes in stream bed substrate composition (e.g., siltation), hydrologic alteration, interactions with other species, nutrient inputs, and habitat destruction were the most common factors. The major sources of stressors to aquatic species are agricultural land use, urban land use, energy generation industries (especially hydroelectric power), and exotic species (Richter et al. 1997). Agricultural activity was identified as having significant adverse effects on aquatic species through non-point source pollution (sediment and nutrients), interactions with exotic species, and water impoundments (Richter et al. 1997). Water impoundments cause changes in hydrology, as well as habitat destruction and fragmentation. Urban land use resulted in much less non-point source pollution than agricultural activities (Richter et al. 1997).

Note that in these studies on species threats and endangerment, the categories of human activities are discussed in general terms, and may include activities in uplands as well as activities in jurisdictional and non-jurisdictional waters and wetlands. Climate change will also alter species distributions, and extinction may occur for those species that cannot adjust to the changes in climate (Starzmoski 2013).

As discussed above, there are many categories of activities not regulated by the Corps under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899 that contribute to cumulative effects to endangered and threatened species and their designated critical habitats. During the 5-year period this NWP is in effect, the activities it authorizes will result in only a no more than minimal incremental contribution to cumulative effects to endangered and threatened species and their habitats.

4.4 Climate Change

Climate change represents one of the greatest challenges our country faces with profound

and wide-ranging implications for the health and welfare of Americans, economic growth, the environment, and international security. Evidence of the warming of climate system is unequivocal and the emission of greenhouse gases from human activities is the primary driver of these changes (IPCC 2014). Already, the United States is experiencing the impacts of climate change and these impacts will continue to intensify as warming intensifies. It will have far-reaching impacts on natural ecosystems and human communities. These effects include sea level rise, ocean warming, increases in precipitation in some areas and decreases in precipitation in other areas, decreases in sea ice, more extreme weather and climate events including more floods and droughts, increasing land surface temperatures, increasing ocean temperatures, and changes in plant and animal communities (IPCC 2014). Climate change also affects human health in some geographic area by increasing exposure to ground-level ozone and/or particulate matter air pollution (Luber et al. 2014). Climate change also increases the frequency of extreme heat events that threaten public health and increases risk of exposure to vector-borne diseases (Luber et al. 2014). Climate impacts affect the health, economic well-being, and welfare of Americans across the country, and especially children, the elderly, and others who are particularly vulnerable to specific impacts. Climate change can affect ecosystems and species through a number of mechanisms, such as direct effects on species, populations, and ecosystems; compounding the effects of other stressors; and the direct and indirect effects of climate change mitigation or adaptation actions (Staudt et al. 2013). Other stressors include land use and land cover changes, natural resource extraction (including water withdrawals), pollution, species introductions, and removals of species (Staudt et al. 2013, Bodkin 2012, MEA 2005d) and changes in nutrient cycling (Julius et al. 2013).

5.0 Public Interest Review

5.1 Public Interest Review Factors (33 CFR 320.4(a)(1))

For each of the 20 public interest review factors, the extent of the Corps consideration of expected impacts resulting from the use of this NWP is discussed, as well as the reasonably foreseeable cumulative adverse effects that are expected to occur. The Corps decision-making process involves consideration of the benefits and detriments that may result from the activities authorized by this NWP.

(a) Conservation: The activities authorized by this NWP may modify the natural resource characteristics of the project area. Compensatory mitigation, if required for activities authorized by this NWP, will result in the restoration, enhancement, establishment, or preservation of aquatic habitats that will offset losses of conservation values. The adverse effects of activities authorized by this NWP on conservation will be minor.

Much of the literature on the effects of riprap bank stabilization activities on rivers and streams is speculative and conflicting (Reid and Church 2015, Fischenich 2003). Riprap in rivers and streams to reduce erosion can result in ecological benefits and improve the quality of habitat in those categories of waters (Fischenich 2003). Examples of benefits includes

reduction of sediment loads, improved water quality, facilitating the re-establishment of riparian vegetation, and habitat for some species of aquatic organisms, especially in rivers and streams that have little hard substrate (Fischenich 2003). In coastal environments, bulkheads decrease biodiversity by 23 percent when compared to natural shorelines (Gittman et al. 2016). Bulkheads also cause decreases in intertidal habitat because of erosion from wave energy reflected from the structure (Dugan et al. 2011). Bulkheads and other hard erosion control structures also losses of transition areas between coastal waters and adjacent lands and reduce connectivity between those areas (Dugan et al. 2011). This NWP has been modified to limit bulkheads to no more than 1,000 linear feet to address adverse effects to biodiversity and shoreline processes.

(b) Economics: Bank stabilization activities will have positive impacts on the local economy. Bank stabilization activities help protect coastal communities from damage from extreme storm events (Sutton-Grier et al. 2015). During construction, these activities will generate jobs and revenue for local contractors as well as revenue to building supply companies that sell construction materials. Bank stabilization activities will protect public and private property, and help landowners retain the value of their properties. Activities authorized by this NWP will also benefit the community by improving the local economic base, which is affected by employment, tax revenues, community services, and property values.

The use of riprap to control bank erosion in rivers and streams is often less expensive than other bank stabilization techniques, as well as being relatively inexpensive to construct and repair (Fischenich 2003). Riprap in rivers and streams also helps protect property and infrastructure from damage due to erosion. Bulkheads are frequently constructed in estuarine environments because they are fairly easy to build, relatively low-cost, and minimize encroachment into coastal waters (Nordstrom 2014).

(c) Aesthetics: Bank stabilization activities will alter the visual character of some waters of the United States. The extent and perception of these changes will vary, depending on the size and configuration of the bank stabilization activity, the nature of the surrounding area, and the public uses of the area. Activities authorized by this NWP can also modify other aesthetic characteristics, such as air quality and the amount of noise. The increased human use of the project area and surrounding land will also alter local aesthetic values.

(d) General environmental concerns: Activities authorized by this NWP will affect general environmental concerns, such as water, air, noise, and land pollution. The authorized activities will also affect the physical, chemical, and biological characteristics of the environment. The adverse effects of the activities authorized by this NWP on general environmental concerns will be minor. Adverse effects to the chemical composition of the aquatic environment will be controlled by general condition 6, which states that the material used for construction must be free from toxic pollutants in toxic amounts. General condition 23 requires mitigation to minimize adverse effects to the aquatic environment through avoidance and minimization at the project site. Compensatory mitigation may be required by district engineers to ensure that the net adverse environmental effects are no more than minimal. Specific environmental concerns are addressed in other sections of this document.

Bank stabilization activities have both beneficial and detrimental environmental effects, depending on the species, river or stream functions, and other environmental criteria being used for that evaluation (Fischenich 2003). The significance of these environmental effects is dependent on site characteristics. For riverine systems, bank stabilization activities have greater effects on river and stream geomorphic processes, sediment processes, and habitat and lesser effects on hydrologic characteristics and chemical processes (Fischenich 2003). Riprap placed along a river or stream bank outside of the active channel has little effect on sediment production or channel morphology, except during large flood events (Reid and Church 2015).

The environmental effects of a bulkhead constructed in coastal environments is dependent on the location of the bulkhead on the shore. Bulkheads constructed near the high tide line have less adverse environmental effects than bulkheads constructed in subtidal waters (NRC 2007). To assist landowners and others in choosing the appropriate approach to managing shoreline erosion, Bilkovic and Mitchell (2013) recommend providing siting and design guidance for living shorelines and other shore protection approaches.

(e) Wetlands: Bank stabilization activities in waters of the United States may result in the loss or alteration of wetlands. In most cases, the affected wetlands will be permanently filled, especially where bank stabilization structures or fills are located, resulting in the permanent loss of aquatic resource functions and values. Wetlands may also be converted to other uses and habitat types. Some wetlands may be temporarily impacted by the activity through the use of temporary staging areas and access roads. These wetlands will be restored, unless the district engineer authorizes another use for the area, but the plant community may be different. Compensatory mitigation may be required to offset the loss of wetlands and ensure that the adverse environmental effects are no more than minimal.

Wetlands provide habitat, including foraging, nesting, spawning, rearing, and resting sites for aquatic and terrestrial species. The loss or alteration of wetlands may alter natural drainage patterns. Wetlands reduce erosion by stabilizing the substrate. Wetlands also act as storage areas for stormwater and flood waters. Wetlands may act as groundwater discharge or recharge areas. The loss of wetland vegetation will adversely affect water quality because these plants trap sediments, pollutants, and nutrients and transform chemical compounds. Wetland vegetation also provides habitat for microorganisms that remove nutrients and pollutants from water. Wetlands, through the accumulation of organic matter, act as sinks for some nutrients and other chemical compounds, reducing the amounts of these substances in the water.

General condition 23 requires avoidance and minimization of impacts to waters of the United States, including wetlands, at the project site. Compensatory mitigation may be required by district engineers to ensure that the net adverse environmental effects are no more than minimal. General condition 22 requires submittal of a pre-construction notification prior to use of this NWP in designated critical resource waters and adjacent wetlands, which may include high value wetlands. District engineers can add case-specific special conditions to the NWP authorization to provide protection to wetlands or require

compensatory mitigation to offset impacts to wetlands.

The construction of bulkheads and seawalls can cause losses intertidal areas and changes in habitat type from soft substrate to hard substrate, which changes the composition of plant and animal communities (NRC 2007).

(f) Historic properties: General condition 20 states that in cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act have been satisfied.

(g) Fish and wildlife values: This NWP authorizes activities in all waters of the United States, including oceans, estuaries, lakes, and rivers, which provide habitat to many species of fish and wildlife. Activities authorized by this NWP may alter the habitat characteristics of open waters, decreasing the quantity and quality of fish and wildlife habitat. Riparian vegetation may be removed to construct the bank stabilization activity. Riparian vegetation provides food and habitat for many species, including foraging areas, resting areas, corridors for wildlife movement, and nesting and breeding grounds. Open waters provide habitat for fish and other aquatic organisms. Woody riparian vegetation shades streams, which reduces water temperature fluctuations and provides habitat for fish and other aquatic animals. Riparian vegetation provides organic matter that is consumed by fish and aquatic invertebrates. Woody riparian vegetation creates habitat diversity in streams when trees and large shrubs fall into the channel, forming snags that provide habitat and shade for fish. The morphology of a stream channel may be altered by activities authorized by this NWP, which can affect fish populations. Compensatory mitigation may be required by district engineers to restore, enhance, establish, and/or preserve wetlands to offset losses of waters of the United States. Stream rehabilitation, enhancement, and preservation activities may be required as compensatory mitigation for impacts to streams. The re-establishment and maintenance of riparian areas next to open and flowing waters may also be required as compensatory mitigation. These methods of compensatory mitigation will provide fish and wildlife habitat values. In waterbodies where substantial amounts of hard shoreline stabilization have been constructed to reduce erosion, mitigation actions (e.g., the construction of habitat benches in front of seawalls or the establishment of pocket beaches in areas dominated by riprap) can be done to provide some habitat features that will be used by fish and other aquatic organisms (Toft et al. 2013). Habitat enhancements along shorelines protected by hard structures can provide benefits for economically valuable fish, especially in urban coastal areas (Bilkovic et al. 2016).

General condition 2 will reduce the adverse effects to fish and other aquatic species by prohibiting activities that substantially disrupt the necessary life cycle movements of indigenous aquatic species, unless the primary purpose of the activity is to impound water. Compliance with general conditions 3 and 5 will ensure that the authorized activity has only minimal adverse effects on spawning areas and shellfish beds, respectively. The authorized activity cannot have more than minimal adverse effects on breeding areas for migratory birds, due to the requirements of general condition 4.

For an NWP activity, compliance with the Bald and Golden Eagle Protection Act (16 U.S.C. 668(a)-(d)), the Migratory Bird Treaty Act (16 U.S.C. 703; 16 U.S.C. 712), and the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.) is the responsibility of the project proponent. General condition 19 states that the permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

Consultation pursuant to the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act will occur as necessary for proposed NWP activities that may adversely affect essential fish habitat. Consultation may occur on a case-by-case or programmatic basis. Division and district engineers can impose regional and special conditions to ensure that activities authorized by this NWP will result in no more than minimal adverse effects on essential fish habitat.

In two reviews, Fischenich (2003) and Reid and Church (2015) found that there are conflicting views of the impacts of riprap on fish and other aquatic organisms: for some species, the impacts are beneficial and for other species the impacts are adverse. Some species of invertebrates and vertebrates favor the habitats provided by riprap, whereas salmonids are usually adversely affected by habitat changes caused by riprap (Reid and Church 2015). Reducing river and stream erosion through the placement of riprap reduces inputs of woody debris into rivers and streams, and changes river and stream structure and function (Reid and Church 2015). The use of riprap in rivers and streams also alters habitat characteristics by causing changes in sediment characteristics, hyporheic water exchange, and associated alterations of riparian areas (Reid and Church 2015). The Corps does not regulate the removal of riparian vegetation from upland riparian areas. The Corps does not regulate the removal of riparian vegetation from wetlands if the vegetation removal activity does not involve discharges of dredged or fill material into waters of the United States.

In coastal environments, shore protection structures alter habitat dynamics and make nearshore habitats more static (Nordstrom 2014). In coastal areas subject to high energy erosive forces, hard structures are necessary to control erosion, but it may be possible to add features to those hard structures that provide some habitat for aquatic organisms without undermining the ability of the erosion control structure to protect the site (Chapman and Underwood 2011). Vegetative bank stabilization approaches, as well as hybrid bank stabilization approaches (vegetation stabilization used in combination with structural stabilization measures), can result in some fish and wildlife values through the habitat provided by vegetation (NRC 2007). Bulkheads in coastal areas provide some habitat for molluscs, algae, and other organisms (NRC 2007). Stone revetments provide habitat for sessile organisms, as well as animals that can occupy the spaces between stone (NRC 2007). Shorelines protected by stone revetments provide habitat for colonization by animals that live on the revetments, but in the revetment footprint there is loss of habitat for the colonization of animals that live in the sediment (Bilkovic and Mitchell 2013). Species diversity and abundance in the vicinity of bulkheads are substantially lower compared to natural shorelines, but for shorelines protected by riprap revetment species diversity and

abundance are similar when compared to natural shorelines (Gittman et al. 2016).

(h) Flood hazards: The activities authorized by this NWP may affect the flood-holding capacity of 100-year floodplains, including surface water flow velocities. Changes in the flood-holding capacity of 100-year floodplains may impact human health, safety, and welfare. Compliance with general condition 9 will reduce flood hazards. This general condition requires the permittee to maintain, to the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters, except under certain circumstances. Much of the land area within 100-year floodplains is upland, and outside of the Corps scope of review.

(i) Floodplain values: Activities authorized by this NWP may affect the flood-holding capacity of the floodplain, as well as other floodplain values. The fish and wildlife habitat values of floodplains may be adversely affected by activities authorized by this NWP, by modifying or eliminating areas used for nesting, foraging, resting, and reproduction. The activities authorized by this NWP are likely to have negligible adverse effects on the water quality functions of floodplains. For those NWP activities that require pre-construction notification, district engineers will review the proposed activities to ensure that those activities result in no more than minimal adverse environmental effects.

Compensatory mitigation may be required for activities authorized by this NWP, which will offset losses of waters of the United States and provide water quality functions and wildlife habitat. General condition 23 requires avoidance and minimization of impacts to waters of the United States to the maximum extent practicable at the project site, which will reduce losses of floodplain values. The mitigation requirements of general condition 23 will help ensure that the adverse effects of these activities on floodplain values are no more than minimal. Compliance with general condition 9 will also ensure that activities in 100-year floodplains will not cause more than minimal adverse effects on flood storage and conveyance.

(j) Land use: Activities authorized by this NWP will have minor direct effects on land use. Bank stabilization activities are usually done where the land has already been developed (NRC 2007). In urban areas, structural bank stabilization measures may be the only practicable approach because of a lack of space for effective use of natural or hybrid approaches to reduce shore erosion (Sutton-Grier et al. 2015, Saleh and Weinstein 2016). The activities authorized by this NWP will help maintain current land use, by protecting property from erosion. Since the primary responsibility for land use decisions is held by state, local, and Tribal governments, the Corps scope of review is limited to significant issues of overriding national importance, such as navigation and water quality (see 33 CFR 320.4(j)(2)).

Some state and local governments have passed rules prohibiting the use of structures to control shore erosion in coastal areas, but those regulations can face legal challenges because landowners want to use protective structures instead of other approaches as coastal hazards increase because of changing environmental conditions (Nordstrom 2014).

In 2010, approximately 39 percent of the United States population lived in coastal counties (NOAA 2013). When people live along the coasts they want to protect their buildings and other infrastructure from shore erosion (Bilkovic and Mitchell 2013). As more people move to coastal areas and as sea level rises, there will be increased demand for shore erosion measures to protect the people living in these areas and the infrastructure that supports them (Chapman and Underwood 2011). Many other people live next to inland rivers and lakes, and they often want to take measures to protect their land from erosion.

(k) Navigation: Activities authorized by this NWP must comply with general condition 1, which states that no activity may cause more than minimal adverse effects on navigation. Bank stabilization activities are usually constructed near the shore, and do not affect navigable access. This NWP requires pre-construction notification for bank stabilization activities that: (1) involve discharges into special aquatic sites; (2) exceed 500 feet in length; or (3) involve the discharge of greater than an average of one cubic yard per running foot along the bank below the plane of the ordinary high water mark or the high tide line. The pre-construction notification requirement will allow district engineers to review certain proposed activities and determine if there will be more than minimal adverse effects on navigation.

(l) Shore erosion and accretion: The nation's coastlines are constantly changing as a result of natural processes and human activities (NRC 2007). The activities authorized by this NWP will reduce shore erosion and will have minor adverse effects on shore accretion processes. The pre-construction notification requirements of this NWP will allow district engineers to review, on a case-by-case basis, larger bank stabilization activities that may have more than minimal adverse effects on shore erosion and accretion processes. For bulkheads, capping the waivers of the 500 linear foot limit at no more than 1,000 linear feet along the shore will minimize cumulative adverse effects to shore erosion and accretion. In addition, division engineers can regionally condition this NWP to restrict or prohibit its use in areas where potential adverse effects to shore erosion and accretion may be more than minimal. Division engineers can also regionally condition this NWP to restrict or prohibit certain types of bank stabilization measures, such as bulkheads and seawalls, that may result in more than minimal adverse environmental effects in specific regions. To manage coastal erosion, a variety of approaches are needed because of the wide range of variability in site conditions and in the effectiveness of different types of built, hybrid, and natural infrastructure to protect coastal areas and the people who live in them.

Shore protection structures alter sediment erosion and accretion in coastal areas, and are constructed to protect buildings and infrastructure in developed coastal zones (Nordstrom 2014). They are a reaction to local land use decisions that allow development of coastal areas (NRC 2007). All types of bank stabilization approaches affect coastal processes, landforms, and habitats, and there needs to be consideration of a variety of components such as ecology, engineering, and socio-political factors, including stakeholder interests (Nordstrom 2014). The impacts of shore erosion control structures on coastal habitat are dependent on the age of those structures, and where they are located along the shore profile (Dugan et al. 2011). Structural shore protection measures such as bulkheads often cause scouring of sediments channelward of those structures, resulting in increased water depths

(NRC 2007).

(m) Recreation: Activities authorized by this NWP may change the recreational uses of the project area. Bank stabilization activities may have minor adverse effects on recreational uses. For example, the installation of bank stabilization measures may reduce the amount of beach available for recreation. Bank stabilization activities may also protect recreational facilities, thereby allowing continued use of those facilities. The construction of bulkheads can cause losses of intertidal habitats that are used for recreational purposes by residents and visitors (NRC 2007). Certain recreational activities, such as beach combing, bird watching, hunting, and fishing may no longer be available in the area.

(n) Water supply and conservation: Activities authorized by this NWP will have negligible adverse effects on surface water and groundwater supplies. Activities authorized by this NWP will not increase demand for potable water in the region. Bank stabilization activities will have little or no adverse effects on the replenishment of groundwater supplies or the amount of water available in reservoirs. Division and district engineers can prohibit the use of this NWP in watersheds for public water supplies, if it is in the public interest to do so. General condition 7 prohibits discharges in the vicinity of public water supply intakes. Compensatory mitigation may be required for activities authorized by this NWP, which will help improve the quality of surface waters.

(o) Water quality: The activities authorized by this NWP may enhance water quality. Bank stabilization activities reduce sediment loads to surface waters by reducing erosion. The loss of riparian vegetation will adversely affect water quality because these plants trap sediments, pollutants, and nutrients and transform chemical compounds. Riparian vegetation also provides habitat for microorganisms that remove nutrients and pollutants from water. Riparian areas also decrease the velocity of flood waters, removing suspended sediments from the water column and reducing turbidity. Riparian vegetation also serves an important role in the water quality of streams by shading the water from the intense heat of the sun. Compensatory mitigation may be required for activities authorized by this NWP, to ensure that the activities do not have more than minimal adverse environmental effects, including water quality. Wetlands and riparian areas restored, established, enhanced, or preserved as compensatory mitigation may provide local water quality benefits.

During construction, small amounts of oil and grease from construction equipment may be discharged into the waterway. Because most of the construction will occur during a relatively short period of time, the frequency and concentration of these discharges are not expected to have more than minimal adverse effects on overall water quality.

This NWP requires a Section 401 water quality certification, since it authorizes discharges of dredged or fill material into waters of the United States. Most water quality concerns are addressed by the state or Tribal Section 401 agency.

(p) Energy needs: The activities authorized by this NWP may temporarily increase energy consumption in the area, especially electricity, natural gas, and petroleum products, during construction. Bank stabilization activities will not adversely affect long-term energy needs.

(q) Safety: Bank stabilization activities provide some degree of safety to waterfront property owners, by reducing hazards due to erosion, especially erosion due to storm events (Sutton-Grier et al. 2015). The activities authorized by this NWP will be subject to federal, state, and local safety laws and regulations. Therefore, this NWP will not adversely affect the safety of the project area.

(r) Food and fiber production: Activities authorized by this NWP will have negligible adverse effects on food and fiber production. Bank stabilization activities may help maintain food and fiber production by protecting farmland from erosion. Food production facilities, such as bakeries, canneries, and meat processing plants, that are constructed near open waters may be protected by bank stabilization activities. The activities authorized by this NWP will have minor adverse effects on aquatic food production, since bank stabilization activities are constructed near the shore.

(s) Mineral needs: Activities authorized by this NWP will increase demand for aggregates and stone, which are used to construct revetments and other bank stabilization measures. Activities authorized by this NWP may increase the demand for other building materials, such as steel, aluminum, and copper, which are made from mineral ores.

(t) Considerations of property ownership: The NWP complies with 33 CFR 320.4(g), which states that an inherent aspect of property ownership is a right to reasonable private use. The activities authorized by this NWP will help landowners protect their property from erosion. The NWP provides expedited DA authorization for discharges of dredged or fill material for bank stabilization activities, provided the activity complies with the terms and conditions of the NWP and results in no more than minimal adverse environmental effects.

As of 2010, 39 percent of the people in the United States live in coastal shoreline counties which are defined as counties abutting oceans, major estuaries, and the Great Lakes (NOAA 2013). These residents often need to construct erosion control measures to protect their property from erosion. Different approaches to shoreline stabilization often have different stakeholder interests (Nordstrom 2014). Many private landowners prefer hard shore protection structures that are perceived as permanent solutions, since they can last for decades, especially along lower energy coastal shores (Nordstrom 2014). Tourists and other non-residents that do not hold property interests are often more interested in aesthetics than the durability of shore protection measures (Nordstrom 2014).

The level of protection needed to stabilize banks and control erosion dictates the type of approach to protect that property. In high energy environments, structural bank stabilization measures are needed to control erosion. In low energy environments, other approaches such as vegetative stabilization may provide a sufficient level of protection for the landowner. In low- to medium-energy environments, hybrid approaches (i.e., combinations of structural and vegetative measures) may be used in some circumstances to provide the desired level of protection for the residence or infrastructure, while providing some ecosystem functions and services. Bulkheads generally last 20 years, depending on the materials used to construct the bulkheads (NRC 2007). Stone revetments usually last 50 years or so, depending on how

well they are constructed (NRC 2007). Nationwide permit 13 authorizes a variety of bank stabilization measures, and offers flexibility to efficiently authorize bank stabilization activities that have no more than minimal individual and cumulative adverse environmental effects.

5.2 Additional Public Interest Review Factors (33 CFR 320.4(a)(2))

5.2.1 Relative extent of the public and private need for the proposed structure or work

This NWP authorizes bank stabilization activities that have no more than minimal individual and cumulative adverse environmental effects. These activities satisfy public and private needs for property protection and safety. The need for this NWP is based upon the number of these activities that occur annually with no more than minimal individual and cumulative adverse environmental effects.

5.2.2 Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work

Most situations in which there are unresolved conflicts concerning resource use arise when environmentally sensitive areas are involved (e.g., special aquatic sites, including wetlands) or where there are competing uses of a resource. The nature and scope of the activity, when planned and constructed in accordance with the terms and conditions of this NWP, reduce the likelihood of such conflict. In the event that there is a conflict, the NWP contains provisions that are capable of resolving the matter (see Section 1.2 of this document).

General condition 23 requires permittees to avoid and minimize adverse effects to waters of the United States to the maximum extent practicable on the project site. Consideration of off-site alternative locations is not required for activities that are authorized by general permits. General permits authorize activities that have no more than minimal individual and cumulative adverse effects on the environment and the overall public interest. The district engineer will exercise discretionary authority and require an individual permit if the proposed activity will result in more than minimal adverse environmental effects on the project site. The consideration of off-site alternatives can be required during the individual permit process.

Landowners and other project proponents (e.g., utility lines, departments of transportation) are responsible for proposing approaches to controlling erosion. For bank stabilization activities authorized by this NWP, if pre-construction notification is required the Corps districts review the pre-construction notifications and determine whether the proposed activities comply with all applicable general and regional conditions and will result in no more than minimal individual and cumulative adverse environmental effects. If a proposed bank stabilization will result in more than minimal adverse environmental effects, the project proponent may redesign the activity to reduce the adverse environmental effects. The redesign may include an alternative approach to bank stabilization. If the project proponent

does not want to alter the proposed bank stabilization activity and the district engineer determines the bank stabilization activity will result in more than minimal adverse environmental effects, he or she will assert discretionary authority and require an individual permit.

Options for bank stabilization are dependent on site characteristics, especially the geomorphology and hydrodynamic of the project site (NRC 2007). Other factors include the costs of constructing and maintaining the bank stabilization activity, how well it controls erosion, the time and resources required to obtain any required permits, and the views of the landowners and any consultants that may provide designs or advice to those landowners (NRC 2007). The range of available options may also be influenced by federal, state, and local laws and regulations, because some jurisdictions restrict or prohibit the use of certain bank stabilization techniques (NRC 2007). Another factor is the fact that shorelines and adjacent lands are the most rigorously regulated lands, and laws and regulations require minimization of impacts to the public trust resources in coastal waters (NRC 2007). These regulations include the Clean Water Act Section 404(b)(1) Guidelines, which require minimization of impacts to jurisdictional waters and wetlands along those shorelines to the maximum extent practicable. Compliance with the 404(b)(1) Guidelines may be accomplished by using the relatively smaller filled areas associated with bulkheads and revetments, compared to larger fills in coastal waters associated with vegetative stabilization (e.g., fringe marsh construction) and other approaches (NRC 2007).

5.2.3 The extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited

The nature and scope of the activities authorized by the NWP will most likely restrict the extent of the beneficial and detrimental effects to the area immediately surrounding the bank stabilization activity. Activities authorized by this NWP will have no more than minimal individual and cumulative adverse environmental effects.

The terms, conditions, and provisions of the NWP were developed to ensure that individual and cumulative adverse environmental effects are no more than minimal. Specifically, NWPs do not obviate the need for the permittee to obtain other federal, state, or local authorizations required by law. The NWPs do not grant any property rights or exclusive privileges (see 33 CFR 330.4(b) for further information). Additional conditions, limitations, restrictions, and provisions for discretionary authority, as well as the ability to add activity-specific or regional conditions to this NWP, will provide further safeguards to the aquatic environment and the overall public interest. There are also provisions to allow suspension, modification, or revocation of the NWP.

6.0 Endangered and Threatened Species

The Corps' current regulations and procedures for the NWPs result in compliance with Section 7 of the Endangered Species Act (ESA) and ensure that activities authorized by this

NWP will not jeopardize the continued existence or any listed threatened and endangered species or result in the destruction or adverse modification of critical habitat. Current local procedures in Corps districts are effective in ensuring compliance with ESA. Those local procedures include regional programmatic consultations and the development of Standard Local Operating Procedures for Endangered Species (SLOPES). The issuance or reissuance of an NWP, as governed by NWP general condition 18 (which applies to every NWP and which relates to endangered and threatened species and critical habitat) and 33 CFR 330.4(f), results in "no effect" to listed species or critical habitat, because no activity that "may affect" listed species or critical habitat is authorized by NWP unless ESA Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS) has been completed. Activities that do not comply with general condition 18 or other applicable general or regional conditions are not authorized by any NWP, and thus fall outside of the NWP Program. Unauthorized activities are subject to the prohibitions of Section 9 of the ESA.

Each activity authorized by an NWP is subject to general condition 18, which states that "[n]o activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species." In addition, general condition 18 explicitly states that the NWP does not authorize "take" of threatened or endangered species, which will ensure that permittees do not mistake the NWP authorization as a Federal authorization to take threatened or endangered species. General condition 18 also requires a non-federal permittee to submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat. This general condition also states that, in such cases, non-federal permittees shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized.

Under the current Corps regulations (33 CFR 325.2(b)(5)), the district engineer must review all permit applications for potential impacts on threatened and endangered species or critical habitat. For the NWP program, this review occurs when the district engineer evaluates the pre-construction notification or request for verification. Nationwide permit general condition 18 requires a non-federal applicant to submit a pre-construction notification to the Corps if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat. Based on the evaluation of all available information, the district engineer will initiate consultation with the USFWS or NMFS, as appropriate, if he or she determines that the proposed activity may affect any threatened and endangered species or critical habitat. Consultation may occur during the NWP authorization process or the district engineer may exercise discretionary authority to require an individual permit for the proposed activity and initiate section 7 consultation during the individual permit process. If ESA Section 7 consultation is conducted during the NWP authorization process without the district engineer exercising discretionary authority, then the applicant will be notified that he or she cannot proceed with the proposed NWP activity until section 7 consultation is completed.

If the district engineer determines that the proposed NWP activity will have no effect on any threatened or endangered species or critical habitat, then the district engineer will notify the applicant that he or she may proceed under the NWP authorization as long as the activity complies with all other applicable terms and conditions of the NWP, including applicable regional conditions. When the Corps makes a "no effect" determination, that determination is documented in the record for the NWP verification.

In cases where the Corps makes a "may affect" determination, formal or informal section 7 consultation is conducted before the activity is authorized by NWP. A non-federal permit applicant cannot begin work until notified by the Corps that the proposed NWP activity will have "no effect" on listed species or critical habitat, or until ESA Section 7 consultation has been completed (see also 33 CFR 330.4(f)). Federal permittees are responsible for complying with ESA Section 7(a)(2) and should follow their own procedures for complying with those requirements (see 33 CFR 330.4(f)(1)). Therefore, permittees cannot rely on complying with the terms of an NWP without considering ESA-listed species and critical habitat, and they must comply with the NWP conditions to ensure that they do not violate the ESA. General condition 18 also states that district engineers may add activity-specific conditions to the NWPs to address ESA issues as a result of formal or informal consultation with the USFWS or NMFS.

Each year, the Corps conducts thousands of ESA section 7 consultations with the FWS and NMFS for activities authorized by NWPs. These section 7 consultations are tracked in ORM2. During the period of March 19, 2012, to September 30, 2016, Corps districts conducted 1,402 formal consultations and 9,302 informal consultations for NWP activities under ESA section 7. During that time period, the Corps also used regional programmatic consultations for 9,829 NWP verifications to comply with ESA section 7. Therefore, each year NWP activities are covered by an average of more than 4,500 formal, informal, and programmatic ESA section 7 consultations with the FWS and/or NMFS. In a study on ESA section 7 consultations tracked by the USFWS, Malcom and Li (2015) found that during the period of 2008 to 2015, the Corps conducted the most formal and informal section 7 consultations, far exceeding the numbers of section 7 consultations conducted by other federal agencies.

Section 7 consultations are often conducted on a case-by-case basis for activities proposed to be authorized by NWP that may affect listed species or critical habitat, in accordance with the USFWS's and NMFS's interagency regulations at 50 CFR part 402. Instead of activity-specific section 7 consultations, compliance with ESA may also be achieved through formal or informal regional programmatic consultations. Compliance with ESA Section 7 may also be facilitated through the adoption of NWP regional conditions. In some Corps districts SLOPES have been developed through consultation with the appropriate regional offices of the USFWS and NMFS to make the process of complying with section 7 more efficient.

Corps districts have, in most cases, established informal or formal procedures with local offices of the USFWS and NMFS, through which the agencies share information regarding threatened and endangered species and their critical habitat. This information helps district

engineers determine if a proposed NWP activity may affect listed species or their critical habitat and, when a "may affect" determination is made, initiate ESA section 7 consultation. Corps districts may utilize maps or databases that identify locations of populations of threatened and endangered species and their critical habitat. Where necessary, regional conditions are added to one or more NWPs to require pre-construction notification for NWP activities that occur in known locations of threatened and endangered species or critical habitat. For activities that require agency coordination during the pre-construction notification process, the USFWS and NMFS will review the proposed activities for potential impacts to threatened and endangered species and their critical habitat. Any information provided by local maps and databases and any comments received during the pre-construction notification review process will be used by the district engineer to make a "no effect" or "may affect" determination for the pre-construction notification.

Based on the safeguards discussed in this section, especially general condition 18 and the NWP regulations at 33 CFR 330.4(f), the Corps has determined that the activities authorized by this NWP will not jeopardize the continued existence of any listed threatened or endangered species or result in the destruction or adverse modification of designated critical habitat. Although the Corps continues to believe that these procedures ensure compliance with the ESA, the Corps has taken some steps to provide further assurance. Corps district offices meet with local representatives of the USFWS and NMFS to establish or modify existing procedures such as regional conditions, where necessary, to ensure that the Corps has the latest information regarding the existence and location of any threatened or endangered species or their critical habitat. Corps districts can also establish, through local procedures or other means, additional safeguards that ensure compliance with the ESA. Through ESA Section 7 formal or informal consultations, or through other coordination with the USFWS and NMFS, the Corps establishes procedures to ensure that the NWP is not likely to jeopardize any threatened and endangered species or result in the destruction or adverse modification of designated critical habitat. Such procedures may result in the development of regional conditions added to the NWP by the division engineer, or in conditions to be added to a specific NWP authorization by the district engineer.

If informal section 7 consultation is conducted, and the USFWS and/or NMFS issues a written concurrence that the proposed activity may affect, but is not likely to adversely affect, listed species or designated critical habitat, the district engineer will add conditions (e.g., minimization measures) to the NWP authorization that are necessary to avoid the likelihood of adverse effects to listed species or designated critical habitat. If the USFWS and/or NMFS does not issue a written concurrence that the proposed NWP activity "may affect, but is not likely to adversely affect" listed species or critical habitat, the Corps will initiate formal section 7 consultation if it changes its determination to "may affect, likely to adversely affect."

If formal section 7 consultation is conducted and a biological opinion is issued, the district engineer will add a condition to the NWP authorization to incorporate the appropriate elements of the incidental take statement of the biological opinion into the NWP authorization, if the biological opinion concludes that the NWP activity is not likely to jeopardize the continued existence of listed species or adversely modify or destroy critical

habitat. If the biological opinion concludes that the proposed activity is likely to jeopardize the continued existence of listed species or adversely modify or destroy critical habitat, the proposed activity cannot be authorized by NWP and the district engineer will instruct the applicant to apply for an individual permit. The incidental take statement includes reasonable and prudent measures such as mitigation, monitoring, and reporting requirements that minimize incidental take. The appropriate elements of the incidental take statement are dependent on those activities in the biological opinion over which the Corps has control and responsibility (i.e., the discharges of dredged or fill material into waters of the United States and/or structures or work in navigable waters and the direct and indirect effects of those activities on listed species or critical habitat). The appropriate elements of the incidental take statement are those reasonable and prudent measures that the Corps has the authority to enforce under its permitting authorities. Incorporation of the appropriate elements of the incidental take statement into the NWP authorization by a binding, enforceable permit condition provides an exemption from the take prohibitions in ESA Section 9 (see Section 7(o)(2) of the ESA).

The Corps can modify this NWP at any time that it is deemed necessary to protect listed species or their critical habitat, either through: 1) national general conditions or national-level modifications, suspensions, or revocations of the NWPs; 2) regional conditions or regional modifications, suspensions, or revocations of NWPs; or 3) activity-specific permit conditions (modifications) or activity-specific suspensions or revocations of NWP authorizations. Therefore, although the Corps has issued the NWPs, the Corps can address any ESA issue, if one should arise. The NWP regulations also allow the Corps to suspend the use of some or all of the NWPs immediately, if necessary, while considering the need for permit conditions, modifications, or revocations. These procedures are provided at 33 CFR 330.5.

7.0 Clean Water Act Section 404(b)(1) Guidelines Analysis

The 404(b)(1) Guidelines compliance criteria for general permits are provided at 40 CFR 230.7. This 404(b)(1) Guidelines compliance analysis includes analyses of the direct, secondary, and cumulative effects on the aquatic environment caused by discharges of dredged or fill material authorized by this NWP.

7.1 Evaluation Process (40 CFR 230.7(b))

7.1.1 Alternatives (40 CFR 230.10(a))

General condition 23 requires permittees to avoid and minimize discharges of dredged or fill material into waters of the United States to the maximum extent practicable on the project site. The consideration of off-site alternatives is not directly applicable to general permits (see 40 CFR 230.7(b)(1)).

7.1.2 Prohibitions (40 CFR 230.10(b))

This NWP authorizes discharges of dredged or fill material into waters of the United States, which require water quality certification. Water quality certification requirements will be met in accordance with the procedures at 33 CFR 330.4(c).

No toxic discharges will be authorized by this NWP. General condition 6 states that the material must be free from toxic pollutants in toxic amounts.

This NWP does not authorize activities that jeopardize the continued existence of any listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. Reviews of pre-construction notifications, regional conditions, and local operating procedures for endangered species will ensure compliance with the Endangered Species Act. Refer to general condition 18 and to 33 CFR 330.4(f) for information and procedures.

This NWP will not authorize the violation of any requirement to protect any marine sanctuary. Refer to section 7.2.3(j)(1) of this document for further information.

7.1.3 Findings of Significant Degradation (40 CFR 230.10(c))

Potential impact analysis (Subparts C through F): The potential impact analysis specified in Subparts C through F is discussed in section 7.2.3 of this document. Mitigation required by the district engineer will ensure that the adverse effects on the aquatic environment are no more than minimal.

Evaluation and testing (Subpart G): Because the terms and conditions of the NWP specify the types of discharges that are authorized, as well as those that are prohibited, individual evaluation and testing for the presence of contaminants will normally not be required. If a situation warrants, provisions of the NWP allow division or district engineers to further specify authorized or prohibited discharges and/or require testing. General condition 6 requires that materials used for construction be free from toxic pollutants in toxic amounts.

Based upon Subparts B and G, after consideration of Subparts C through F, the discharges authorized by this NWP will not cause or contribute to significant degradation of waters of the United States.

7.1.4 Factual determinations (40 CFR 230.11)

The factual determinations required in 40 CFR 230.11 are discussed in section 7.2.3 of this document.

7.1.5 Appropriate and practicable steps to minimize potential adverse impacts (40 CFR 230.10(d))

As demonstrated by the information in this document, as well as the terms, conditions, and provisions of this NWP, actions to minimize adverse effects (Subpart H) have been

thoroughly considered and incorporated into the NWP. General condition 23 requires permittees to avoid and minimize discharges of dredged or fill material into waters of the United States to the maximum extent practicable on the project site. Compensatory mitigation may be required by the district engineer to ensure that the net adverse effects on the aquatic environment are no more than minimal.

7.2 Evaluation Process (40 CFR 230.7(b))

7.2.1 Description of permitted activities (40 CFR 230.7(b)(2))

As indicated by the text of this NWP in section 1.0 of this document, and the discussion of potential impacts in section 4.0, the activities authorized by this NWP are sufficiently similar in nature and environmental impact to warrant authorization under a single general permit. Specifically, the purpose of the NWP is to authorize discharges of dredged or fill material for bank stabilization activities. The nature and scope of the impacts are controlled by the terms and conditions of the NWP.

The activities authorized by this NWP are sufficiently similar in nature and environmental impact to warrant authorization by a general permit. The terms of the NWP authorize a specific category of activity (i.e., discharges of dredged or fill material for bank stabilization activities) in a specific category of waters (i.e., waters of the United States). The restrictions imposed by the terms and conditions of this NWP will result in the authorization of activities that have similar impacts on the aquatic environment, namely the replacement of aquatic habitats, such as open waters, with structures or fills designed to reduce erosion.

If a situation arises in which the activity requires further review, or is more appropriately reviewed under the individual permit process, provisions of the NWPs allow division and/or district engineers to take such action.

7.2.2 Cumulative effects (40 CFR 230.7(b)(3))

The 404(b)(1) Guidelines at 40 CFR 230.11(a) define cumulative effects as "…the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material." For the issuance of general permits, such as this NWP, the 404(b)(1) Guidelines require the permitting authority to "set forth in writing an evaluation of the potential individual and cumulative impacts of the categories of activities to be regulated under the general permit." [40 CFR 230.7(b)] More specifically, the 404(b)(1) Guidelines cumulative effects assessment for the issuance or reissuance of a general permit is to include an evaluation of "the number of individual discharge activities likely to be regulated under a general permit until its expiration, including repetitions of individual discharge activities at a single location." [40 CFR 230.7(b)(3)] If a situation arises in which cumulative effects are likely to be more than minimal and the proposed activity requires further review, or is more appropriately reviewed under the individual permit process, provisions of the NWPs allow division and/or district engineers to take such action.

Based on reported use of this NWP during the period of March 19, 2012, to March 12, 2015, the Corps estimates that this NWP will be used approximately 2,700 times per year on a national basis, resulting in impacts to approximately 70 acres of waters of the United States, including jurisdictional wetlands. The reported use includes pre-construction notifications submitted to Corps districts, as required by the terms and conditions of the NWP as well as regional conditions imposed by division engineers. The reported use also includes voluntary notifications to submitted to Corps districts where the applicants request written verification in cases when pre-construction notification is not required. The reported use does not include activities that do not require pre-construction notification and were not voluntarily reported to Corps districts. The Corps estimates that 500 NWP 13 activities will occur each year that do not require pre-construction notification, and that these activities will impact 10 acres of jurisdictional waters each year.

Based on reported use of this NWP during that time period, the Corps estimates that 2 percent of the NWP 13 verifications will require compensatory mitigation to offset the authorized impacts to waters of the United States and ensure that the authorized activities result in only minimal adverse effects on the aquatic environment. The verified activities that do not require compensatory mitigation will have been determined by Corps district engineers to result in no more than minimal individual and cumulative adverse effects on the aquatic environment without compensatory mitigation. During 2017-2022, the Corps expects little change to the percentage of NWP 13 verifications requiring compensatory mitigation, because there have been no substantial changes in the mitigation general condition or the NWP regulations for determining when compensatory mitigation is to be required for NWP activities. The Corps estimates that approximately 20 acres of compensatory mitigation will be required each year to offset authorized impacts. The demand for these types of activities could increase or decrease over the five-year duration of this NWP.

Based on these annual estimates, the Corps estimates that approximately 16,000 activities could be authorized over a five year period until this NWP expires, resulting in impacts to approximately 400 acres of waters of the United States, including jurisdictional wetlands. Approximately 100 acres of compensatory mitigation would be required to offset those impacts. Compensatory mitigation is the restoration (re-establishment or rehabilitation), establishment, enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. [33 CFR 332.2] For bank stabilization activities, mitigation can be provided by installing habitat features in those activities or in the water near those activities (e.g., Toft et al. 2013, Chapman and Underwood 2011)

Wetland restoration, enhancement, and establishment projects can provide wetland functions, as long as the wetland compensatory mitigation project is placed in an appropriate landscape position, has appropriate hydrology for the desired wetland type, and the watershed condition will support the desired wetland type (NRC 2001). Site selection is critical to find a site with appropriate hydrologic conditions and soils to support a

replacement wetland that will provide the desired wetland functions and services (Mitsch and Gosselink 2015). The ecological performance of wetland restoration, enhancement, and establishment is dependent on practitioner's understanding of wetland functions, allowing sufficient time for wetland functions to develop, and allowing natural processes of ecosystem development (self-design or self-organization) to take place, instead of over-designing and over-engineering the replacement wetland (Mitsch and Gosselink (2015). Most studies of the ecological performance of compensatory mitigation projects have focused solely on the ecological attributes of the compensatory mitigation projects, and few studies have also evaluated the aquatic resources impacted by permitted activities (Kettlewell et al. 2008), so it is difficult to assess whether compensatory mitigation has fully or partially offset the lost functions provided by the aquatic resources that are impacted by permitted activities. In its review, the NRC (2001) concluded that some wetland types can be restored or established (e.g., non-tidal emergent wetlands, some forested and scrub-shrub wetlands, sea grasses, and coastal marshes), while other wetland types (e.g., vernal pools, bogs, and fens) are difficult to restore and should be avoided where possible. Restored riverine and tidal wetlands achieved wetland structure and function more rapidly than depressional wetlands (Moreno-Mateos et al. 2012). Because of its greater potential to provide wetland functions, restoration is the preferred compensatory mitigation mechanism (33 CFR 332.3(a)(2)). Bogs, fens, and springs are considered to be difficult-to-replace resources and compensatory mitigation should be provided through in-kind rehabilitation, enhancement, or preservation of these wetlands types (33 CFR 332.3(e)(3)).

In its review of outcomes of wetland compensatory mitigation activities, the NRC (2001) stated that wetland functions can be replaced by wetland restoration and establishment activities. They discussed five categories of wetland functions: hydrology, water quality, maintenance of plant communities, maintenance of animal communities, and soil functions. Wetland functions develop at different rates in wetland restoration and establishment projects (NRC 2001). It is difficult to restore or establish natural wetland hydrology, and water quality functions are likely to be different than the functions provided at wetland impact sites (NRC 2001). Reestablishing or establishing the desired plant community may be difficult because of invasive species colonizing the mitigation project site (NRC 2001). The committee also found that establishing and maintaining animal communities depends on the surrounding landscape. Soil functions can take a substantial amount of time to develop, because they are dependent on soil organic matter and other soil properties (NRC 2001). The NRC (2001) concluded that the ecological performance in replacing wetland functions depends on the particular function of interest, the restoration or establishment techniques used, and the extent of degradation of the compensatory mitigation project site and its watershed.

The ecological performance of wetland restoration and enhancement activities is affected by the amount of changes to hydrology and inputs of pollutants, nutrients, and sediments within the watershed or contributing drainage area (Wright et al. 2006). Wetland restoration is becoming more effective at replacing or improving wetland functions, especially in cases where monitoring and adaptive management are used to correct deficiencies in these efforts (Zedler and Kercher 2005). Wetland functions take time to develop after the restoration or enhancement activity takes place (Mitsch and Gosselink 2015, Gebo and Brooks 2012), and

different functions develop at different rates (Moreno-Mateos 2012). Irreversible changes to landscapes, especially those that affect hydrology within contributing drainage areas or watersheds, cause wetland degradation and impede the ecological performance of wetland restoration efforts (Zedler and Kercher 2005). Gebo and Brooks (2012) evaluated wetland compensatory mitigation projects in Pennsylvania and compared them to reference standards (i.e., the highest functioning wetlands in the study area) and natural reference wetlands that showed the range of variation due to human disturbances. They concluded that most of the wetland mitigation sites were functioning at levels within with the range of functionality of the reference wetlands in the region, and therefore were functioning at levels similar to some naturally occurring wetlands. The ecological performance of mitigation wetlands is affected by on the landscape context (e.g., urbanization) of the replacement wetland and varies with wetland type (e.g., riverine or depressional) (Gebo and Brooks 2012). Moreno-Mateos and others (2012) conducted a meta-analysis of wetland restoration studies and concluded that while wetland structure and function can be restored to a large degree, the ecological performance of wetland restoration projects is dependent on wetland size and local environmental setting. They found that wetland restoration projects that are larger in size and in less disturbed landscape settings achieve structure and function more quickly.

Streams are difficult-to-replace resources and compensatory mitigation should be provided through stream rehabilitation, enhancement, and preservation since those techniques are most likely to be ecologically successful (see 33 CFR 332.3(e)(3)). Stream rehabilitation is usually the most effective compensatory mitigation mechanism since restoring a stream to a historic state is not possible because of changes in land use and other activities in a watershed (Roni et al. 2008). Stream rehabilitation and enhancement projects, including the restoration and preservation of riparian areas, provide riverine functions (e.g., Allan and Castillo (2007) for rivers and streams, NRC (2002) for riparian areas). Improvements in ecological performance of stream restoration projects is dependent on the restoration method and how outcomes are assessed (Palmer et al. 2014). Non-structural and structural techniques can be used to rehabilitate and enhance streams, and restore riparian areas (NRC 1992). Non-structural practices include removing disturbances to allow recovery of stream and riparian area structure and function, reducing or eliminating activities that have altered stream flows to restore natural flows, preserving or restoring floodplains, and restoring and protecting riparian areas, including fencing those areas to exclude livestock and people (NRC 1992). Structural rehabilitation and enhancement techniques include dam removal, as well as channel, bank, and/or riparian area modifications to improve river and stream habitat (NRC 1992).

The restoration and enhancement of river and stream functions and services can be improved through a variety of techniques and in many cases combinations of these techniques are used (Roni et al. 2013). Examples of stream restoration and enhancement techniques include: dam removal and modification, culvert replacement or modification, fish passage structures when connectivity cannot be restored or improved by dam removal or culvert replacement, levee removal or setbacks, reconnecting floodplains and other riparian habitats, road removal, road modifications, reducing sediment and pollution inputs to streams, replacing impervious surfaces with pervious surfaces, restoring adequate in-stream or base flows, restoring riparian areas, fencing streams and their riparian areas to exclude livestock,

improving in-stream habitat, recreating meanders, and replacing hard bank stabilization structures with bioengineering bank stabilization measures (Roni et al. 2013). Road improvements, riparian rehabilitation, reconnecting floodplains to their rivers, and installing in-stream habitat structures have had varying degrees of ecological performance in stream rehabilitation activities (Roni et al. 2008). The ecological performance of these stream rehabilitation activities is strongly dependent on addressing impaired water quality and insufficient water quantity, since those factors usually limit the biological response to stream rehabilitation efforts (Roni et al. 2008). Ecologically successful stream rehabilitation and enhancement activities depend on addressing the factors that most strongly affect stream functions, especially water quality, water flow, and riparian quality, and not focusing solely on rehabilitating or enhancing the physical habitat of streams (Palmer et al. 2010). The ability to restore the ecological functions of streams is dependent on the condition of the watershed draining to the stream being restored because human land uses and other activities in the watershed affect how that stream functions (Palmer et al. 2014). Stream restoration projects should focus on restoring ecological processes, such as dam removal, watershed best management practices, improving the riparian zone, and reforestation, instead of focusing on the manipulation the structure of the stream channel (Palmer et al. 2014).

For compensatory mitigation projects, restoration is the preferred mechanism (see 33 CFR 332.3(a)(2). In an analysis of 89 ecosystem restoration projects, Rey Banayas et al. (2009) concluded that restoration activities can increase biodiversity and the level of ecosystem services provided. However, such increases do not approach the amounts of biodiversity and ecosystem services performed by undisturbed reference sites. The ability to restore ecosystems to provide levels of functions and services similar to historic conditions or reference standard conditions is influenced by human impacts to watersheds and other types of landscapes (e.g., urbanization, agriculture) and to the processes that sustain those ecosystems (Zedler et al. 2012, Hobbs et al. 2014). Those changes need to be taken into account when establishing goals and objectives for restoration projects (Zedler et al. 2012), including compensatory mitigation projects. The ability to reverse ecosystem degradation to restore ecological functions and services is dependent on the degree of degradation of that ecosystem and the surrounding landscape, and whether that degradation is reversible (Hobbs et al. 2014).

As discussed in section 3.0, the status of waters and wetlands in the United States as reported under the provisions of Sections 303(d) and 305(b) of the Clean Water Act exhibits considerable variation, ranging from good to threatened to impaired. One of the criteria that district engineers consider when they evaluate proposed NWP activities is the "degree or magnitude to which the aquatic resources perform these functions" (see paragraph 1 of Section D, "District Engineer's Decision." The quality of the affected waters is considered by district engineers when making decisions on whether to require compensatory mitigation for proposed NWP activities to ensure no more than minimal adverse environmental effects (see 33 CFR 330.1(e)(3)), and amount of compensatory mitigation required (see 33 CFR 332.3(f)). The quality of the affected waters also factors into the determination of whether the required compensatory mitigation offsets the losses of aquatic functions caused by the NWP activity.

The compensatory mitigation required by district engineers in accordance with general condition 23 and activity-specific conditions will provide aquatic resource functions and services to offset some or all of the losses of aquatic resource functions caused by the activities authorized by this NWP, and reduce the contribution of those activities to the cumulative effects on the Nation's wetlands, streams, and other aquatic resources. The required compensatory mitigation must be conducted in accordance with the applicable provisions of 33 CFR part 332, which requires development and implementation of approved mitigation plans, as well as monitoring to assess ecological success in accordance with ecological performance standards established for the compensatory mitigation project. The district engineer will evaluate monitoring reports to determine if the compensatory mitigation project has fulfilled its objectives and is ecological successful. [33 CFR 332.6] If the monitoring efforts indicate that the compensatory mitigation project is failing to meet its objectives, the district engineer may require additional measures, such as adaptive management or alternative compensatory mitigation, to address the compensatory mitigation project's deficiencies. [33 CFR 332.7(c)]

According to Dahl (2011), during the period of 2004 to 2009 approximately 489,620 acres of former upland were converted to wetlands as a result of wetland reestablishment and establishment activities. Efforts to reestablish or establish wetlands have increased wetland acreage in the United States.

The individual and cumulative adverse effects on the aquatic environment resulting from the activities authorized by this NWP will be no more than minimal. The Corps expects that the convenience and time savings associated with the use of this NWP will encourage applicants to design their projects within the scope of the NWP, including its limits, rather than request individual permits for projects that could result in greater adverse impacts to the aquatic environment. Division and district engineers will restrict or prohibit this NWP on a regional or case-specific basis if they determine that these activities will result in more than minimal individual and cumulative adverse effects on the aquatic environment.

7.2.3 Section 404(b)(1) Guidelines Impact Analysis, Subparts C through F

(a) Substrate: Discharges of dredged or fill material into waters of the United States will alter the substrate of those waters, usually replacing the aquatic area with dry land, and changing the physical, chemical, and biological characteristics of the substrate. The original substrate will be removed or covered by other material, such as concrete, asphalt, soil, gravel, etc. Temporary fills may be placed upon the substrate, but must be removed upon completion of the activity (see general condition 13). Higher rates of erosion may result during construction, but general condition 12 requires the use of appropriate measures to control soil erosion and sediment.

Bank stabilization activities alter aquatic habitat functional and structural characteristics because those projects interrupt erosion processes to support social (e.g., protection of infrastructure) or ecological needs (e.g., reduce sediment inputs to waterbodies) (Fischenich 2003). Riprap can reduce or eliminate lateral instability of river or stream channels, and it also alters downstream sediment transport rates (Reid and Church 2015). The reduction of

sediment supply caused by the placement of riprap may cause changes to downstream river and stream bed characteristics or erosion in other areas of the river or stream to make up for the sediment deficit (Reid and Church 2015).

While bulkheads, seawalls, and revetments minimize direct alteration of nearshore coastal habitats, they cause indirect effects that result in losses or narrowing of beaches through passive or active erosion, and reduce sediment transport to other beaches (Nordstrom 2014).

(b) Suspended particulates/turbidity: Depending on the method of construction, soil erosion and sediment control measures, equipment, composition of the bottom substrate, and wind and current conditions during construction, fill material placed in open waters will temporarily increase water turbidity. Pre-construction notification is required for certain activities authorized by this NWP, such as discharges of dredged or fill material into jurisdictional special aquatic sites, which will allow the district engineer to review those activities and ensure that adverse effects on the aquatic environment are no more than minimal. Particulates will be resuspended in the water column during removal of temporary fills. The turbidity plume will normally be limited to the immediate vicinity of the disturbance and should dissipate shortly after each phase of the construction activity. General condition 12 requires the permittee to stabilize exposed soils and other fills, which will reduce turbidity. NWP activities cannot create turbidity plumes that smother important spawning areas downstream (see general condition 3).

(c) Water: Bank stabilization activities may affect some characteristics of water, such as water clarity, chemical content, dissolved gas concentrations, pH, and temperature. These activities can change the chemical and physical characteristics of the waterbody by introducing suspended or dissolved chemical compounds into the water. Changes in water quality can affect the species and quantities of organisms inhabiting the aquatic area. Water quality certification is required for activities authorized by this NWP, which will ensure that the activities do not violate applicable water quality standards.

(d) Current patterns and water circulation: Activities authorized by this NWP may adversely affect the movement of water in the aquatic environment. Certain bank stabilization activities authorized by this NWP require pre-construction notification to the district engineer. These activities will be reviewed on a case-by-case basis to ensure that the adverse effects on the aquatic environment are no more than minimal. General condition 9 requires the authorized activity to be designed to withstand expected high flows and to maintain the course, condition, capacity, and location of open waters to the maximum extent practicable. General condition 10 requires activities to comply with applicable FEMA-approved state or local floodplain management requirements, which will reduce adverse effects to surface water flows. Activities authorized by this NWP may affect the geomorphology of jurisdictional waters by altering substrate depth and form by changing current patterns and water circulation, including the interaction between waves and shorelines in coastal waters.

Riprap in rivers and streams can increase channel roughness, which alters the velocity of water movement through the river or stream channel (Reid and Church 2015). Bank

stabilization activities in rivers and streams can alter water regimes by increasing water storage through changes in bank roughness, creating barriers to surface/subsurface water exchanges, and modifying how water flows through the stream channel (Fischenich 2003).

(e) Normal water level fluctuations: The activities authorized by this NWP will have negligible adverse effects on normal patterns of water level fluctuations due to tides and flooding. To ensure that the NWP does not authorize activities that adversely affect normal flooding patterns, general condition 9 requires the permittee to maintain the pre-construction course, condition, capacity, and location of open waters, to the maximum extent practicable.

(f) Salinity gradients: The activities authorized by this NWP are unlikely to adversely affect salinity gradients, since it authorizes bank stabilization activities. Bank stabilization activities typically do not change water flow patterns that could modify salinity gradients.

(g) Threatened and endangered species: The NWPs do not authorize activities that will jeopardize the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended. In addition, the NWPs do not authorize activities that will destroy or adversely modify critical habitat of those species. See 33 CFR 330.4(f) and paragraph (a) of general condition 18. For NWP activities, compliance with the Endangered Species Act is discussed in more detail in section 6.0 of this document.

(h) Fish, crustaceans, molluscs, and other aquatic organisms in the food web. Fish and other motile animals will avoid the project site during construction. Sessile or slow-moving animals in the path of discharges, equipment, and building materials will be destroyed. Some aquatic animals may be smothered by the placement of fill material. Motile animals will return to those areas that are temporarily impacted by the activity and restored or allowed to revert back to preconstruction conditions. Aquatic animals will not return to sites of permanent fills, unless those fills provide habitat for those aquatic animals. Stone revetments provide habitat for aquatic organisms that live on the surface of the rocks, but in the revetment footprint result in loss of habitat for organisms that live in soft substrates (Bilkovic and Mitchell 2013). Benthic and sessile animals are expected to recolonize sites temporarily impacted by the activity, after those areas are restored. Activities that alter the riparian zone, may adversely affect populations of fish and other aquatic animals, by altering stream flow, flooding patterns, and surface and groundwater hydrology. Some species of fish spawn on floodplains, which could be prevented if the activity involves clearing or filling the floodplain. Bank stabilization activities in the vicinity of streams may alter habitat features by increasing surface water flow velocities, which can increase erosion and reduce the amount of habitat for aquatic organisms and destroy spawning areas. Bank stabilization activities in the vicinity of streams can also cause more unstable flow regimes, such as higher peak flows, more frequent dry periods, and more frequent flooding, which may decrease the amount of habitat for aquatic animals. Some bank stabilization activities, such as stone riprap or stone sills, may provide habitat for aquatic organisms and refuges from predators because of the crevices between stones used for these features. Stone revetments convert soft-bottom intertidal habitats to habitats resembling rocky shorelines (Bilkovic and Mitchell 2013). Seawalls and bulkheads can be constructed with features, such as crevices, pools, or boulders placed seaward of the seawall or bulkhead, that provide

some additional habitat value for aquatic organisms (Chapman and Underwood 2011).

Division and district engineers can place conditions on this NWP to prohibit discharges during important stages of the life cycles of certain aquatic organisms. Such time of year restrictions can prevent adverse effects to these aquatic organisms during reproduction and development periods. General conditions 3 and 5 address protection of spawning areas and shellfish beds, respectively. General condition 3 states that activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. In addition, general condition 3 also prohibits activities that result in the physical destruction of important spawning areas. General condition 5 prohibits activities in areas of concentrated shellfish populations. General condition 9 requires the maintenance of pre-construction course, condition, capacity, and location of open waters to the maximum extent practicable, which will help minimize adverse impacts to fish, shellfish, and other aquatic organisms in the food web.

Bank stabilization activities can be designed to improve river and stream functions, including habitat for aquatic organisms, by including vegetation plantings with riprap or by protecting and maintaining the riparian area during construction (Fischenich 2003). The use of riprap to stabilize river and stream banks in areas highly degraded through intensive land uses such as logging may help improve the quality of river or stream habitat (Reid and Church 2015). The effects of riprap on vertebrates inhabiting rivers and streams are highly variable, and are site-specific and species-specific (Reid and Church 2015). Sills can increase the diversity of animals in nearshore areas by providing sheltered habitat (NRC 2007).

(i) Other wildlife: Activities authorized by this NWP will result in adverse effects on other wildlife associated with aquatic ecosystems, such as resident and transient mammals, birds, reptiles, and amphibians, through the destruction of aquatic habitat, including breeding and nesting areas, escape cover, travel corridors, and preferred food sources. This NWP does not authorize activities that jeopardize the continued existence of Federally-listed endangered and threatened species or result in the destruction or adverse modification of critical habitat. Compensatory mitigation, including the establishment and maintenance of riparian areas next to open waters, may be required for activities authorized by this NWP, which will help offset losses of aquatic habitat for wildlife. General condition 4 states that activities in breeding areas for migratory birds must be avoided to the maximum extent practicable.

Bulkheads, seawalls, and revetments can sever connectivity between nearshore estuarine and marine environments and adjacent uplands, preventing or inhibiting the ability of animals to move between these environments (Nordstrom 2014, NRC 2007). Over time, the intertidal zone may erode away, changing it to subtidal habitat (Nordstrom 2014). These adverse effects may be reduced by using revetments instead of bulkheads or seawalls (Nordstrom 2014). In coastal areas where soft-bottom habitat is the dominant habitat, stone revetments can provide habitat for organisms that prefer that rocky habitat over soft-bottom habitat (Bilkovic and Mitchell 2013).

(j) Special aquatic sites: The potential impacts to specific special aquatic sites are discussed

below:

(1) Sanctuaries and refuges: The activities authorized by this NWP will have only minimal adverse effects on waters of the United States within sanctuaries or refuges designated by Federal or state laws or local ordinances. General condition 22 requires submittal of a pre-construction notification prior to the use of this NWP in NOAA-designated marine sanctuaries and marine monuments and National Estuarine Research Reserves. District engineers will exercise discretionary authority and require individual permits for specific projects in waters of the United States in sanctuaries and refuges if those activities will result in more than minimal adverse effects on the aquatic environment.

(2) Wetlands: The activities authorized by this NWP will have no more than minimal adverse effects on wetlands. This NWP requires pre-construction notification for all discharges of dredged or fill material into wetlands. District engineers will review pre-construction notifications for proposed discharges of dredged or fill material into jurisdictional wetlands to ensure that the adverse effects on the aquatic environment are no more than minimal. Division engineers can regionally condition this NWP to restrict or prohibit its use in certain high value wetlands. If the wetland is high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit. See paragraph (e) of section 5.1 for a more detailed discussion of impacts to wetlands.

(3) Mud flats: The activities authorized by this NWP will have only minimal adverse effects on mud flats. This NWP requires pre-construction notification for all discharges of dredged or fill material into mud flats. District engineers will review pre-construction notifications for proposed discharges of dredged or fill material into jurisdictional mud flats to ensure that the adverse effects on the aquatic environment are no more than minimal. Division engineers can regionally condition this NWP to restrict or prohibit its use in specific high value mud flats. If the mud flat is high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit.

(4) Vegetated shallows: The activities authorized by this NWP will have only minimal adverse effects on vegetated shallows. This NWP requires pre-construction notification for all discharges of dredged or fill material into vegetated shallows. District engineers will review pre-construction notifications for proposed discharges of dredged or fill material into jurisdictional vegetated shallows to ensure that the adverse effects on the aquatic environment are no more than minimal. Division engineers can regionally condition this NWP to restrict or prohibit its use in specific high value vegetated shallows. If the vegetated shallows are high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit.

(5) Coral reefs: The activities authorized by this NWP will have no more than

minimal adverse effects on coral reefs. This NWP requires pre-construction notification for all discharges of dredged or fill material into coral reefs. District engineers will review pre-construction notifications for proposed discharges of dredged or fill material into these special aquatic sites to ensure that the adverse effects on the aquatic environment are no more than minimal. Division engineers can regionally condition this NWP to restrict or prohibit its use in specific high value coral reefs. If the coral reef is high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit.

(6) Riffle and pool complexes: The activities authorized by this NWP will have only minimal adverse effects on riffle and pool complexes. This NWP requires pre-construction notification for all discharges of dredged or fill material into riffle and pool complexes. District engineers will review pre-construction notifications for proposed discharges of dredged or fill material into jurisdictional riffle and pool complexes to ensure that the adverse effects on the aquatic environment are no more than minimal. Division engineers can regionally condition this NWP to restrict or prohibit its use in specific high value riffle and pool complexes. If the riffle and pool complexes are high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit.

The responses of rivers and streams to the placement of riprap to control erosion are dependent on how far the riprap is placed from the active channel, the length of channel treated, sediment texture, and channel morphology (Reid and Church 2015). The effects of riprap on river and stream ecology and geomorphology are context dependent, with different effects on rivers and streams in relatively undisturbed condition versus degraded rivers and streams (Reid and Church 2015).

(k) Municipal and private water supplies: See paragraph (n) of section 5.1 for a discussion of potential impacts to water supplies.

(l) Recreational and commercial fisheries, including essential fish habitat: The activities authorized by this NWP may adversely affect waters of the United States that act as habitat for populations of economically important fish and shellfish species. The construction of living shorelines may substantially reduce the structure and composition of shallow subtidal communities (Bilkovic and Mitchell 2013) through the placement of fill material and other habitat changes. Division and district engineers can condition this NWP to prohibit discharges during important life cycle stages, such as spawning or development periods, of economically valuable fish and shellfish. Certain activities authorized by this NWP require pre-construction notification to the district engineer, which will allow case-specific review of those activities to ensure that adverse effects to economically important fish and shellfish are no more than minimal. Compliance with general conditions 3 and 5 will ensure that the authorized activity does not adversely affect important spawning areas or concentrated shellfish populations. As discussed in paragraph (g) of section 5.1, there are procedures to help ensure that impacts to essential fish habitat are no more than minimal, individually or

cumulatively. For example, division and district engineers can impose regional and special conditions to ensure that activities authorized by this NWP will result in only minimal adverse effects on essential fish habitat.

(m) Water-related recreation: See paragraph (m) of section 5.1 above.

(n) Aesthetics: See paragraph (c) of section 5.1 above.

(o) Parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar areas: General condition 22 requires submittal of a pre-construction notification prior to the use of this NWP in designated critical resource waters and adjacent wetlands, which may be located in parks, national and historical monuments, national seashores, wilderness areas, and research sites. This NWP can be used to authorize activities in parks, national and historical monuments, national seashores, wilderness areas, and research sites if the manager or caretaker wants to conduct activities in waters of the United States and those activities result in no more than minimal adverse effects on the aquatic environment. Division engineers can regionally condition the NWP to prohibit its use in designated areas, such as national wildlife refuges or wilderness areas.

8.0 Determinations

8.1 Finding of No Significant Impact

Based on the information in this document, the Corps has determined that the issuance of this NWP will not have a significant impact on the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required.

8.2 Public Interest Determination

In accordance with the requirements of 33 CFR 320.4, the Corps has determined, based on the information in this document, that the issuance of this NWP is not contrary to the public interest.

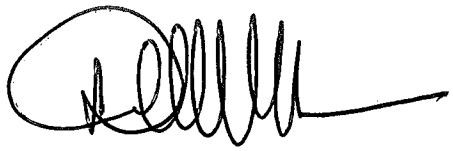
8.3 Section 404(b)(1) Guidelines Compliance

This NWP has been evaluated for compliance with the 404(b)(1) Guidelines, including Subparts C through G. Based on the information in this document, the Corps has determined that the discharges authorized by this NWP comply with the 404(b)(1) Guidelines, with the inclusion of appropriate and practicable conditions, including mitigation, necessary to minimize adverse effects on affected aquatic ecosystems. The activities authorized by this NWP will result in no more than minimal individual and cumulative adverse effects on the aquatic environment.

8.4 Section 176(c) of the Clean Air Act General Conformity Rule Review

This NWP has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. It has been determined that the activities authorized by this permit will not exceed *de minimis* levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons, a conformity determination is not required for this NWP.

FOR THE COMMANDER



Dated: 21 Dec 2016

Donald E. Jackson
Major General, U.S. Army
Deputy Commanding General
for Civil and Emergency Operations

9.0 References

Allan, J.D. 2004. Landscapes and Riverscapes: The Influence of Land Use on Stream Ecosystems. Annual Review of Ecology, Evolution, and Systematics. 35:257–284.

Allan, J.D. and M.M. Castillo. 2007. Stream Ecology: Structure and Function of Running Waters, 2nd edition. Springer (The Netherlands). 436 pp.

Beechie, T. J.S. Richardson, A.M. Gurnell, and J. Negishi. 2013. Watershed processes, human impacts, and process-based restoration. In, Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats. Edited by P. Roni and T. Beechie. Wiley and Sons, Inc. (West Sussex, UK), pp. 11-49.

Benstead, J.P. and D.S. Leigh. 2012. An expanded role for river networks. Nature Geoscience 5:678-679.

Bilkovic, D.M. and M.M. Mitchell. 2013. Ecological tradeoffs of stabilized salt marshes as a shoreline protection strategy: Effects of artificial structures on microbenthic assemblages. Ecological Engineering 61:469-481.

Bilkovic, D.M., M.M. Mitchell, P. Mason, and K. Duhring. 2016. The role of living shorelines as estuarine habitat conservation strategies. Coastal Management 44:161-174.

Bodkin, D.B. 2012. The Moon in the Nautilus Shell: Discordant Harmonies Reconsidered from Climate Change to Species Extinction, How Life Persists in an Ever-Changing World. Oxford University Press (New York, New York). 424 pp.

Booth, D.B., J.R. Karr, S. Schauman, C.P. Konrad, S.A. Morley, M.G. Larson, and S.J. Burges. 2004. Reviving urban streams: Land use, hydrology, biology, and human behavior. Journal of the American Water Resources Association. 40:1351-1364.

Brinson, M.M. and A.I. Malvárez. 2002. Temperate freshwater wetlands: type, status and threats. Environmental Conservation 29:115-133.

Brooks, R.T. and E.A. Colburn. 2011. Extent and channel morphology of unmapped headwater stream segments of the Quabbin watershed, Massachusetts. Journal of the American Water Resources Association 47:158-168.

Brown, T.C. and P. Froemke. 2012. Nationwide assessment of non-point source threats to water quality. Bioscience 62:136-146.

Butman, D. and P.A. Raymond. 2011. Significant efflux of carbon dioxide from streams and rivers in the United States. Nature Geoscience 4:839–842.

Carpenter, S.R., E.H. Stanley, and J.M. Vander Zanden. 2011. State of the world's freshwater ecosystems: Physical, chemical, and biological changes. Annu. Rev. Environ.

Resources. 36:75-99.

Chapman, M.G. and A.J. Underwood. 2011. Evaluation of ecological engineering of "armoured" shorelines to improve their value as habitat. Journal of Experimental Marine Biology and Ecology 400:302-313.

Council on Environmental Quality (CEQ). 1997. Considering cumulative effects under the National Environmental Policy Act.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79-31. 131 pp.

Czech, B. and P.R. Krausman. 1997. Distribution and causation of species endangerment in the United States. Science 277:1116-1117.

Dahl, T.E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. 108 pp.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 21 pp.

Dahl, T.E. and C.E. Johnson. 1991. Status and Trends of Wetlands in the Conterminous United States, Mid-1970s to Mid-1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. 28 pp.

Dale, V.H., S. Brown, R.A. Haeuber, N.T. Hobbs, N. Huntly, R.J. Naiman, W.E. Riebsame, M.G. Turner, and T.J. Valone. 2000. Ecological principles and guidelines for managing the use of land. Ecological Applications 10:639-670.

Deegan, L.A., D.S. Johnson, R.S. Warren, B.J. Peterson, J.W. Fleeger, S. Fagherazzi, and W.M. Wollheim. 2012. Coastal eutrophication as a driver of salt marsh loss. Nature 490:388-392.

Dudgeon, D. A.H. Arthington, M.O. Gessner, Z.-I. Kawabata, D.J. Knowler, C. Lévêque, R.J. Naiman, A.-H. Prieur-Richard, D. Soto, M.L.J. Stiassny, and C.A. Sullivan. 2005. Freshwater biodiversity: importance, threats, status and conservation challenges. Biological Reviews 81:163-182.

Dugan, J.E., L. Airoldi, M.G. Chapman, S.J. Walker, and T. Schlacher. 2011. Estuarine and coastal structures: environmental effects, a focus on shore and nearshore structures. In: Wolanski, E. and D. McLusky (eds), Treatise on Estuarine and Coastal Science, Elsevier Press, New York, pp. 17-41.

Ellis, E.C., K.K. Goldewijk, S. Siebert, D. Lightman, and N. Ramankutty. 2010. Anthropogenic transformation of the biomes, 1700 to 2000. Global Ecology and

Biogeography 19:589-606.

Ellis, E.C. and N. Ramankutty. 2008. Putting people in the map: Anthropogenic biomes of the world. Frontiers in Ecology and the Environment 6:439-447.

Elmore, A.J., J.P. Julian, S.M. Guinn, and M.C. Fitzpatrick. 2013. Potential stream density in mid-Atlantic watersheds. PLOS ONE 8:e74819

Enwright, N.M., K.T. Griffith, and M.J. Osland. 2016. Barriers to and opportunities for landward migration of coastal wetlands with sea level rise. Frontiers in Ecology and the Environment 14:307-316.

Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC.

Fennessy, M.S., A.D. Jacobs, and M.E. Kentula. 2007. An evaluation of rapid methods for assessing the ecological condition of wetlands. Wetlands 27:543-560.

Fischenich, J.C., 2003. Effects of riprap on riverine and riparian ecosystems. ERDC/EL TR-03-4. U.S. Army Engineer Research and Development Center, Vicksburg, MS. 53 pp.

Fischenich, J.C. 2006. Functional objectives for stream restoration. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-52). Vicksburg, MS: U.S. Army Engineer Research and Development Center. 18 pp.

Foley, J.A., R. DeFries, G.P. Asner, C. Barford, G. Bonan, S.R. Carpenter, F.S. Chapin, M.T. Coe, G.C. Daily, H.K. Gibbs, J.H. Helkowski, T. Holloway, E.A. Howard, C.J. Kucharik, C. Monfreda, J.A. Patz, I.C. Prentice, N. Ramankutty, and P.K. Snyder. 2005. Global consequences of land use. Science 309:570-574.

Frayer, W.E., T.J. Monahan, D.C. Bowden, F.A. Graybill. 1983. Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States: 1950s to 1970s. Department of the Interior, U.S. Fish and Wildlife Service. Washington, DC. 32 pp.

Gebo, N.A. and R.P. Brooks. 2012. Hydrogeomorphic (HGM) assessments of mitigation sites compared to natural reference wetlands in Pennsylvania. Wetlands 32:321-331.

Gergel, S.E., M.G. Turner, J.R. Miller, J.M. Melack, and E.H. Stanley. 2002. Landscape indicators of human impacts to riverine systems. Aquatic Sciences 64:118-128.

Gittman, R.K, F.J. Fodrie, A.M. Popowich, D.A. Keller, J.F. Bruno, C.A. Currin, C.H. Peterson, and M.F. Piehler. 2015. Engineering away our natural defenses: an analysis of shoreline hardening in the United States. Frontiers in Ecology and the Environment 13:301-307.

Gittman, R.K., S.B. Scyphers, C.S. Smith, I.P. Neylan, and J.H. Grabowski. 2016. Ecological consequences of shoreline hardening: A meta-analysis. Bioscience 66:763-773.

Gosselink, J.G. and L.C. Lee. 1989. Cumulative impact assessment in bottomland hardwood forests. Wetlands 9:83-174.

Hall, J.V., W.E. Frayer, and B.O. Wilen. 1994. Status of Alaska Wetlands. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. 33 pp.

Halpern, B.S., S. Walbridge, K.A. Selkoe, C.V. Kappel, F. Micheli, C. D'Agrosa, J.F. Bruno, K.S. Casey, C. Ebert, H.E. Fox, R. Fujita, D. Heinemann, H.S. Lenihan, E.M. P. Madin, M.T. Perry, E.R. Selig, M. Spalding, R. Steneck, and R. Watson. 2008. A global map of human impact on marine ecosystems. Science 319:948-952.

Hansen, W.F. 2001. Identifying stream types and management implications. Forest Ecology and Management 143:39-46.

Harris, L.D. and J.G. Gosselink. 1990. Cumulative impacts of bottomland hardwood forest conversion on hydrology, water quality, and terrestrial wildlife. In: Ecological Processes and Cumulative Impacts: Illustrated by Bottomland Hardwood Wetland Ecosystems. Ed. by J.G. Gosselink, L.C. Lee, and T.A. Muir. Lewis Publishers, Inc. (Chelsea, MI). pp. 260-322.

Hobbs, R.J., E. Higgs, C.M. Hall, P. Bridgewater, F.S. Chapin III, E.C. Ellis, J.J. Ewel, L.M. Hallett, J. Harris, K.B. Hulvey, S.T. Jackson, P.L. Kennedy, C. Kueffer, L. Lach, T.C. Lantz, A.E. Lugo, J. Mascaro, S.D. Murphy, C.R. Nelson, M.P. Perring, D.M. Richardson, T.R. Seastedt, R.J. Standish, B.M. Starzomski, K.N. Suding, P.M. Tognetti, L. Yakob, and L. Yung. 2014. Managing the whole landscape: historical, hybrid, and novel ecosystems. Frontiers in Ecology and the Environment 12:557-564.

Intergovernmental Panel on Climate Change (IPCC). 2014. Climate change 2014: synthesis report. Contributions of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPPC, Geneva, Switzerland, 151 pp.

Julius, S.H., J.M. West, D. Nover, R. Hauser, D.S. Schimel, A.C. Janetos, M.K. Walsh, and P. Backlund. 2013. Climate change and U.S. natural resources: Advancing the nation's capacity to adapt. Ecological Society of America. Issues in Ecology, Report Number 18. 17 pp.

Kettlewell, C.I., V. Bouchard, D. Porej, M. Micacchion, J.J. Mack, D. White, and L. Fay. 2008. An assessment of wetland impacts and compensatory mitigation in the Cuyahoga River watershed, Ohio, USA. Wetlands 28:57-67.

King, D.M., Wainger, L.A., C.C. Bartoldus, and J.S. Wakeley. 2000. Expanding wetland assessment procedures: Linking indices of wetland function with services and values.

ERDC/EL TR-00-17, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Kirwan, M.L., S. Temmerman, E.E. Skeehan, G.R. Guntenpergen, and S. Fagherazzi. 2016. Overestimation of marsh vulnerability to sea level rise. Nature Climate Change 6:253-260.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. Fluvial Processes in Geomorphology. Dover Publications, Inc. (New York). 522 pp.

Leopold, L.B. 1994. A View of the River. Harvard University Press (Cambridge). 298 pp.

Leopold. L.B. 1968. Hydrology for urban land planning – A guidebook on the hydrologic effects of urban land use. Department of the Interior. U.S. Geological Survey. Geological Survey Circular 554. 18 pp.

Luber, G., K. Knowlton, J. Balbus, H. Frumkin, M. Hayden, J. Hess, M. McGeehin, N. Sheats, L. Backer, C. B. Beard, K. L. Ebi, E. Maibach, R. S. Ostfeld, C. Wiedinmyer, E. Zielinski-Gutiérrez, and L. Ziska. 2014. Chapter 9: Human Health. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 220-256. doi:10.7930/J0PN93H5.

Malcom, J.W. and Y.-W. Li. 2015. Data contradict common perceptions about a controversial provision of the U.S. Endangered Species Act. Proceedings of the National Academy of Sciences (early edition). www.pnas.org/cg/doi/10.1073/pnas.1516938112

Malmqvist, B. and S. Rundle. 2002. Threats to running water ecosystems of the world. Environmental Conservation 29:134-153.

Meyer, J.L. and J.B. Wallace. 2001. Lost linkages and lotic ecology: rediscovering small streams. In Ecology: Achievement and Challenge. Ed. by M.C. Press, N.J. Huntly, and S. Levin. Blackwell Science (Cornwall, Great Britain). pp. 295-317.

Millar, C.I. and L.B. Brubaker. 2006. Climate change and paleoecology: New contexts for restoration ecology. In: Foundations of Restoration Ecology, edited by D.A. Falk, M.A. Palmer, and J.B. Zedler. Island Press (Washington, DC). Chapter 15, pages 315-340.

Millennium Ecosystem Assessment (MEA). 2005a. Ecosystems and Human Well-being: Current State and Trends, Volume 1, Chapter 19, Coastal Ecosystems. Island Press (Washington, DC). pp 513-549.

Millennium Ecosystem Assessment (MEA). 2005b. Ecosystems and Human Well-Being: Wetlands and Water Synthesis. World Resources Institute, Washington, DC. 68 pp.

Millennium Ecosystem Assessment (MEA). 2005c. Ecosystems and human well-being: Biodiversity synthesis. World Resources Institute, Washington, DC. 86 pp.

Millennium Ecosystem Assessment (MEA). 2005d. Ecosystems and Human Well-Being: Synthesis. Island Press, Washington, DC. 137 pp.

Mitsch, W.J. and J.G. Gosselink. 2015. Wetlands. 5th edition. John Wiley and Sons, Inc. (Hoboken, New Jersey) 736 pp.

Mitsch, W.J. and M.E. Hernandez. 2013. Landscape and climate change threats to wetlands of North and Central America. Aquatic Sciences 75:133-149.

Moreno-Mateos, D., M.E. Power, F.A. Comìn, R. Yockteng. 2012. Structural and functional loss in restored wetland ecosystems. PLoS Biol 10(1): e1001247. doi:10.1371/journal.pbio.1001247

National Oceanic and Atmospheric Administration and the U.S. Census Bureau (NOAA). 2013. National Coastal Population Report: Population Trends from 1970 to 2020. NOAA State of the Coast Report Series. 22 pp.

National Oceanic and Atmospheric Administration (NOAA). 1975. The Coastline of the United States. http://shoreline.noaa.gov/_pdf/Coastline_of_the_US_1975.pdf (accessed October 23, 2014).

National Research Council (NRC). 1986. Ecological Knowledge and Environmental Problem-Solving: Concepts and Case-Studies. National Academy Press (Washington, DC). 388 pp.

National Research Council (NRC). 1992. Restoration of Aquatic Ecosystems. National Academy Press (Washington, DC). 552 pp.

National Research Council (NRC). 1994. Priorities for Coastal Ecosystem Science. National Academy Press (Washington, DC). 118 pp.

National Research Council (NRC). 1995. Wetlands: Characteristics and Boundaries. National Academy Press (Washington, DC). 306 pp.

National Research Council (NRC). 2001. Compensating for Wetland Losses Under the Clean Water Act. National Academy Press (Washington, DC). 322 pp.

National Research Council (NRC). 2002. Riparian Areas: Functions and Strategies for Management National Academy Press (Washington, DC). 444 pp.

National Research Council (NRC). 2007. Mitigating Shore Erosion Along Sheltered Coasts. National Academy Press (Washington, DC). 174 pp.

Nordstrom, K.F. 2014. Living with shore protection structures: A review. Estuarine, Coast, and Shelf Science. 150:11-23.

Nickerson, C., R. Ebel, A. Borchers, and F. Carriazo. 2011. Major Uses of Land in the United States, 2007, EIB-89, U.S. Department of Agriculture, Economic Research Service, December 2011.

Odum, W.E. 1982. Environmental degradation and the tyranny of small decisions. Bioscience. 32:728-729.

Palmer, M.A., K.L. Hondula, and B.J. Koch. 2014. Ecological restoration of streams and rivers: Shifting strategies and shifting goals. Annual Review of Ecology, Evolution, and Systematics. 45:247-269.

Palmer, M.A., H.L. Menninger, and E. Bernhardt. 2010. River restoration, habitat heterogeneity, and biodiversity: a failure of theory or practice? Freshwater Biology 55:205-222.

Paul, M.J. and J.L. Meyer. 2001. Streams in the urban landscape. Annual Review of Ecology and Systematics. 32:333-365.

Peterson, C.H. and J. Lubchenco. 1997. Marine ecosystem services, in Nature's Services: Societal Dependence on Natural Ecosystems. Edited by G.C. Daily. Island Press (Washington, DC). pp. 177-194.

Pilkey, O.H., N. Longo, R. Young, and A. Coburn. 2012. Rethinking living shorelines. http://www.wcu.edu/WebFiles/PDFs/PSDS_Living_Shorelines_White_Paper.pdf (accessed September 16, 2016).

Popkin, G. 2015. Breaking the waves. Science 350:756-759.

Postel, S. and S. Carpenter. 1997. Freshwater ecosystem services, in Nature's Services: Societal Dependence on Natural Ecosystems. Edited by G.C. Daily. Island Press (Washington, DC). pp. 195-214.

Reid, D. and M. Church. 2015. Geomorphic and ecological consequences of riprap placement in river systems. Journal of the American Water Resources Association. 1-17. DOI: 10.1111/jawr.12279

Reid, L.M. 1993. Research and cumulative watershed effects. U.S. Department of Agriculture, U.S. Forest Service General Technical Report PSW-GTR-141. 118 pp.

Rey Benayas, J.M., A.C. Newton, A. Diaz, and J.M. Bullock. 2009. Enhancement of biodiversity and ecosystems by ecological restoration: a meta-analysis. Science 325:1121-1124.

Richter, B.D., D.P. Braun, M.A. Mendelson, and L.L. Master. 1997. Threats to imperiled freshwater fauna. Conservation Biology 11:1081-1093.

Roni, P., K. Hanson, and T. Beechie. 2008. Global review of the physical and biological effectiveness of stream habitat rehabilitation techniques. North American Journal of Fisheries Management 28:856-890.

Roni, P., G. Pess, K. Hanson, and M. Pearsons. 2013. Selecting appropriate stream and watershed restoration techniques. In, Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats. Edited by P. Roni and T. Beechie. Wiley and Sons, Inc. (West Sussex, UK), pp. 144-188.

Royal Society (RS) and the National Academy of Sciences (NAS). 2014. Climate change evidence and causes: An overview from the Royal Society and the U.S. National Academy of Sciences. 34 pp.

Saleh, F. and M.P. Weinstein. 2016. The role of nature-based infrastructure (NBI) in coastal resiliency planning: A literature review. Journal of Environmental Management 183:1088-1098.

Smith, R.D., Ammann, A., Bartoldus, C., and Brinson, M.M. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Starzomski, B.M. 2013. Novel ecosystems and climate change. In: Novel Ecosystems: Intervening in the New Ecological World Order, First Edition. Edited by R.J. Hobbs, E.S. Higgs, and C.M. Hall. John Wiley and Sons, Ltd. (West Sussex, UK). pp. 88-101.

Staudt, A. A.K. Leidner, J. Howard, K.A. Brauman, J.S. Dukes, L.J. Hansen, C. Paukert, J. Sabo, and L.A. Solórzano. 2013. The added complications of climate change: understanding biodiversity and ecosystems. Frontiers in Ecology and Environment 11:494-501.

Steffen, W., P.J. Crutzen, and J.R. McNeill. 2007. The Anthropocene: Are humans overwhelming the forces of nature? Ambio 36:614-621

Sutton-Grier, A.E., K. Wouk, and H. Bamford. 2015. Future of our coasts: The potential for natural and hybrid infrastructure to enhance the resilience of our coastal communities, economies, and ecosystems. Environmental Science and Policy 51:137-148.

Tiner, R. 1997a. NWI maps: Basic information on the Nation's wetlands. Bioscience 47:269.

Tiner, R. 1997b. NWI maps: What they tell us. National Wetlands Newsletter. 19:7-12.

Tiner, R.W. 1999. Wetland Indicators: A Guide to Wetland Identification, Delineation, Classification, and Mapping. Lewis Publishers (Boca Raton, FL) 392 pp.

Toft, J.D., A.S. Ogston, S.M. Heerhartz, J.R. Cordell, and E.E. Flemer. 2013. Ecological response and physical stability of habitat enhancements along an urban armored shoreline. Ecological Engineering 57:97-108.

U.S. Department of Agriculture. 2015. Summary Report: 2012 National Resources Inventory, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. http://www.nrcs.usda.gov/technical/nri/12summary (accessed January 21, 2016)

U.S. Environmental Protection Agency (U.S. EPA). 2015. National Summary of State Information. http://ofmpub.epa.gov/waters10/attains_index.control (accessed May 27, 2015).

U.S. Environmental Protection Agency (U.S. EPA). 2016. National Wetland Condition Assessment 2011: A Collaborative Survey of the Nation's Wetlands. EPA-843-R-15-005. Office of Wetlands, Oceans, and Watersheds, Office of Research and Development (Washington, DC). 105 pp.

Venter, O., N.N. Brodeur, L. Nemiroff, B. Belland, I.J. Dolinsek, and J.W.A. Grant. 2006. Threats to endangered species in Canada. Bioscience. 56:903-910.

Vitousek, P.M., H.A. Mooney, J. Lubchenco, and J.M. Melillo. 1997. Human domination of the Earth's ecosystems. Science 277:494-499.

Walter, R.C. and D.J. Merritts. 2008. Natural streams and the legacy of water-powered mills. Science 319:299-304.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Philips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. Bioscience. 48:607-615.

Wright, T., J. Tomlinson, T. Schueler, K. Cappiella, A. Kitchell, and D. Hirschman. 2006. Direct and indirect impacts of urbanization on wetland quality. Wetlands and Watersheds Article #1. Center for Watershed Protection (Ellicott City, Maryland). 81 pp.

Zedler, J.B., J.M. Doherty, and N.A. Miller. 2012. Shifting restoration policy to address landscape change, novel ecosystems, and monitoring. Ecology and Society 17:36.

Zedler, J.B. and S. Kercher. 2005. Wetland resources: Status, trends, ecosystem services, and restorability. Annual Review Environmental Resources. 30:39-74.