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Planning
Aquatic Ecosystem Restoration Civil Works Mission and Evaluation Procedures

FOR THE COMMANDER:

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Purpose. This pamphlet provides information in support of Engineer Regulation 1105-2-103 and other policies to guide United States Army Corps of Engineers involvement in Civil Works aquatic ecosystem restoration programs and activities. This pamphlet applies to all aquatic ecosystem restoration studies and projects formulated as single purpose aquatic ecosystem restoration plans or multi-purpose projects including ecosystem restoration components. The focus of United States Army Corps of Engineers ecosystem restoration projects is the restoration of ecosystems and ecological resources and not restoration of cultural and historic resources, aesthetic resources, or cleanup of hazardous and toxic wastes.

Applicability. This pamphlet is applicable to all United States Army Corps of Engineers Headquarters elements and commands having responsibility for aquatic ecosystem restoration authorities, programs, studies, and projects in the Civil Works program. However, this pamphlet does not apply to the Regulatory Program.

Distribution Statement. Approved for public release, distribution is unlimited.

Proponent and Exception Authority. The proponent of this pamphlet is the United States Army Corps of Engineers Headquarters Planning and Policy Division. The proponent has the authority to approve exceptions or waivers to this pamphlet that are consistent with controlling law and regulations. Only the proponent of a publication or form may modify it by officially revising or rescinding it.

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Chapter 1
Introduction

1–1. Purpose

This pamphlet provides information in support of ER 1105-2-103 and other policies to guide U.S. Army Corps of Engineers (USACE) involvement in Civil Works aquatic ecosystem restoration programs and activities. This pamphlet applies to all aquatic ecosystem restoration studies and projects formulated as single purpose ecosystem restoration plans or multi-purpose projects including ecosystem restoration components. The focus of USACE ecosystem restoration projects is the restoration of ecosystems and ecological resources and not restoration of cultural and historic resources, aesthetic resources, or cleanup of hazardous and toxic wastes.

1–2. Distribution statement

Approved for public release, distribution is unlimited.

1–3. References

See Appendix A.

1–4. Records management (recordkeeping) requirements

The records management requirement for all record numbers, associated forms, and reports required by this publication are addressed in the Army Records Retention Schedule. Detailed information for all related record numbers is located on the U.S. Army Corps of Engineers (USACE) Records Management Site https://usace.dps.mil/sites/INTRA-CIOG6/SitePages/Records-Management.aspx. If any record numbers, forms, and reports are not current, addressed, and/or published correctly, see DA Pam 25-403 for guidance

1–5. Associated publications

Policies associated with this pamphlet are found in ER 1105-2-103.

Chapter 2
Authorities

2–1. Federal interest

a. Numerous federal laws establish national policy for, and federal interest in, the protection, restoration, conservation, and management of environmental resources. These provisions include compliance requirements and emphasize protecting environmental quality. They endorse federal efforts to advance environmental goals.

b. General statements in legislation declare national policy to be that full consideration be given to the conservation and restoration opportunities that federal actions afford to ecological resources. These authorities are generally granted to the Secretary of the Army (Secretary) and carried out by the Assistant Secretary of the Army for Civil Works (ASA(CW)) through USACE.

c. Water resources authorizations have enhanced opportunities for USACE involvement in studies, projects, and partnerships to specifically address objectives related to the restoration and protection of ecological resources. Specific authorities for individual studies and projects to restore ecological resources have also been enacted.

d. Examples of laws that broadly support federal involvement in restoration include:

(1) Federal Water Project Recreation Act of 1965, as amended: “[I]n investigating and planning any Federal navigation, flood control, reclamation, hydroelectric, or multiple-purpose water resource project, full consideration shall be given to the opportunities, if any, which the project affords for outdoor recreation and for fish and wildlife enhancement.” (Public Law (PL) 89-72)

(2) Clean Water Act, as amended: “The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.” (33 USC 1251 et seq.)

(3) Water Resources Development Act (WRDA) of 1986: “The Secretary is authorized to review the operation of water resources projects…to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest.” (PL 99-662)

(4) WRDA 1990: “There is established, as part of the Corps of Engineers water resources development program, an interim goal of no overall net loss of the Nation's remaining wetlands base, as defined by acreage and function, and a long-term goal to increase the quality and quantity of the Nation's wetlands…The Secretary shall utilize all appropriate authorities, including those to restore and create wetlands, in meeting the interim and long-term goals.” (PL 101-640)

(5) WRDA 1996: “The Secretary may carry out an aquatic ecosystem restoration and protection project if the Secretary determines that the project (1) will improve the

quality of the environment and is in the public interest; and (2) is cost-effective." (PL 104-303)

(6) Water Resources Reform and Development Act (WRRDA) of 2014: "For authorized projects with a primary purpose of ecosystem restoration, the Secretary shall give funding priority to projects—(1) that—(A) address an identified threat to public health, safety, or welfare; (B) preserve or restore ecosystems of national significance; or (C) preserve or restore habitats of importance for federally protected species, including migratory birds; and (2) for which the restoration activities will contribute to other ongoing or planned Federal, State, or local restoration initiatives." (PL 113-121)

2–2. U.S. Army Corps of Engineers aquatic ecosystem restoration mission

a. The aquatic ecosystem restoration mission is distinct from other USACE environmental programs, including regulatory permitting, Civil Works mitigation, and military environmental programs. Aquatic ecosystem restoration is a primary mission of USACE. Ecosystem restoration features may be considered in single purpose projects or in multiple purpose projects along with navigation, flood risk management, or other purposes, wherever those restoration features improve the functions and services performed by the ecosystem. Similar to other project purposes, the value of ecosystem restoration outputs must equal or exceed their cost.

b. Aquatic ecosystem restoration efforts will involve a comprehensive examination of the problems contributing to the ecosystem's degradation, and the development of alternative means for their solution. The intent of ecosystem restoration is to, partially or fully, reestablish the attributes of a naturalistic, functioning, and self-regulating system. The roles of various plant and animal populations and related habitats must be considered in the larger context of community and ecosystem frameworks rather than maximizing habitat benefits for a single species or a resource commodity. Ecosystem restoration projects may not be able to address every functional and structural characteristic, nor may it be necessary where the nature and degree of impairment are limited to only one or a few of these parameters. Some restoration projects may only be able to address the symptoms of the disturbance or degradation, and not the cause(s), but restoration projects should strive to reduce or eliminate causes of aquatic ecosystem degradation to facilitate the recovery physical, chemical, and biological processes that drive ecosystem structure and function.

c. This pamphlet covers the USACE aquatic ecosystem restoration mission. USACE will focus its restoration efforts on those initiatives most closely tied to USACE missions and areas of expertise. There may be instances of ecosystem restoration problems or opportunities that are better addressed by other agencies, through their missions and programs. Recommendations for restoration projects will identify USACE actions to improve the degraded ecosystem function and structure of significant aquatic ecosystems, through the application of the USACE's engineering and other technical expertise related to solving water and related land resources problems, as opposed to projects that primarily rely on land acquisition to achieve the projected outputs. Restoration opportunities that are associated with wetlands, riverine systems (including

riparian areas and floodplains), and other types of aquatic systems are most appropriate for USACE involvement.

d. Recommended restoration actions may include, but are not limited to:

(1) Use of dredged material to restore wetlands;

(2) Restoring floodplain function by reconnecting floodplains, oxbows, and riparian wetlands to the main river channel;

(3) Providing for more natural river corridor conditions needed to support ecosystem structure and function including restoration of riparian vegetation and sediment transport;

(4) Modifying obstructions to fish passage, including dam removal;

(5) Modifying dams and their operations to improve dissolved oxygen levels or temperature downstream or to improve sediment transport;

(6) Removal of drainage structures and levees to restore wetland hydrology; and

(7) Restoring conditions conducive to native aquatic and riparian vegetation. This may include the removal of invasive species.

e. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of ecosystem structure and functions. Such measures are most appropriate if they require USACE engineering expertise in accomplishing the measure. Protection measures can also be undertaken as part of Civil Works natural resources management, water control management, and environmental dredging activities.

f. Actions by other federal and non-federal partners that are required to realize the ecosystem outputs of recommended USACE-funded actions must be identified in decision documents as part of the recommended plan. Recommendation of additional non-USACE actions to further address ecosystem problems identified within a study area is encouraged, but those recommendations should be clearly distinguished from any plan recommended for authorization.

g. Aquatic ecosystem restoration projects may include terrestrial buffer areas of limited width, if supported by the specific project objectives and scientific research. Under very limited circumstances, a case may be made to support other terrestrial restoration as a cost-shared effort, if it is closely linked and critical to the functioning of an aquatic ecosystem restoration project. Additional terrestrial restoration work may be identified for implementation by others. The option of recommending such work as a locally preferred plan should be considered. Consideration of participation in terrestrial restoration should be coordinated with the vertical team as early in planning as possible and must be clearly described in the decision document. See CECW memorandum

(Policy Guidance on Authorization and Budget Evaluation Criteria for Aquatic Ecosystem Restoration Projects), 15 March 2007.

2–3. Authorities

Tracing the history of aquatic ecosystem restoration authority reveals links to federal environmental conservation and protection laws, including the Fish and Wildlife Coordination Act (PL 85-624) and the Clean Water Act (33 USC 1251 et seq.). However, it is important to recognize the difference between conservation and protection actions and the authorities for ecosystem restoration planning. Although most of these activities may fall under the general umbrella of environmental work, the legal foundations, implementation programs, partnering requirements, and technical approaches are generally different. Federal conservation and protection activities are typically more regulatory in nature while ecosystem restoration work is typically founded on partnerships to solve problems. Conservation activities may focus on protecting something that exists while restoration work aims to improve degraded systems.

a. The foundational authorities for the USACE ecosystem restoration mission fall into four broad categories:

(1) General authority for USACE to restore degraded ecosystems;

(2) Beneficial use of dredged material;

(3) Assessment of the impacts of constructed civil works projects and recommendations for project modifications; and

(4) Various requirements applicable to all ecosystem restoration projects.

b. The types of authorities through which USACE can participate in ecosystem restoration and protection studies and project implementation include:

(1) Specific studies authorized and pursued under General Investigations (including new start feasibility studies, post-authorization studies, and completed works studies) for single-purpose ecosystem restoration projects or multiple purpose projects that include ecosystem restoration.

(a) Individually authorized studies and projects may be either single purpose or multiple purpose, depending upon the authorization. Some projects may be formulated to address only ecosystem restoration objectives, while others may address both ecosystem restoration objectives and other USACE missions (for example flood risk management) or a suite of USACE missions. Multipurpose plans, with both economic and environmental tradeoffs and outputs, can be developed and recommended. During a feasibility study, consideration can be given to the integration of ecosystem restoration features in the project, consistent with the guidance in ER 1105-2-103, rather than separate projects. Restoration opportunities may be considered in conjunction with general reevaluation analyses and as part of post-authorization change reports.

(b) Opportunities for ecosystem restoration and protection may be pursued through existing project authorities for the management of operating projects (for example, through water control changes) or as part of natural resources management. Restoration measures that utilize only operational and management changes, which can be accomplished without additional cost, may be undertaken under existing discretionary operating authority. Other restoration needs and opportunities as part of stewardship efforts may be considered for implementation in the budget process.

(2) Continuing Authorities Program studies and projects authorized and pursued under one of the USACE continuing authorities that include ecosystem restoration (EP 1105-2-58).

(3) Programmatic authorities for the study, design, and implementation of ecosystem restoration and protection projects. For examples, see paragraph 4–7.b(1)(b).

c. Over a dozen federal laws form the underlying authority for the USACE Civil Works ecosystem restoration mission. These laws provide authority for projects with improvement of an ecosystem as a stand-alone justification. Other laws may provide specific regional or local authorizations for ecosystem restoration work including investigations and implementation actions. Teams should pay close attention to the various authorities and be clear in connecting planning work to a general or project-specific authority. Congress has enacted many amendments to the foundational ecosystem restoration authorities. Some of the amendments clarify and expand the original authorizations, and in some cases the amendments add additional considerations and requirements. Teams should ensure the most up to date authority is understood and mapped to the underlying ecosystem problems being considered.

(1) The earliest general authority for environmental quality improvement work, Section 216 of the River and Harbor and Flood Control Act of 1970, as amended (33 USC 549a), allows the evaluation of the impact of constructed Civil Works projects on the environment and for the review of project operations and to recommend modifications to improve the quality of the environment.

(2) Section 150 of WRDA 1976 (42 USC 1962d-5e) authorizes the Secretary of the Army, acting through the Chief of Engineers, to establish wetland areas with dredged material from water resources development projects. The section set a cost limit for such purposes and requires the benefits of establishing wetlands to be at least equal to the costs of establishing the area.

(3) In the mid-1980s Congress enacted the first specific ecosystem restoration continuing authority. Section 1135 of WRDA 1986, as amended (33 USC 2309a) provided continuing authority to modify structures and operations of Civil Works projects to improve the environment to the extent the original authorized purposes are not adversely affected. 33 USC 2309a was amended by Section 204 of PL 104-303to set non-federal sponsor cost share and to cap the federal cost on individual projects. Additional amendments have subsequently modified the authority. For example, Section

1030 of PL 113-121increased the funding limits for continuing authority programs including the sections related to aquatic ecosystem restoration. For more information on the implementation of USACE's Continuing Authorities Program, see EP 1105-2-58.

(4) Section 22 of WRDA 1974, as amended (42 USC 1962d–16) created the Planning Assistance to States program authorizing the Secretary of the Army, acting through the Chief of Engineers, to cooperate with States, groups of States, non-federal interests, local governments, Tribes and Territories in preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources of drainage basins located within the boundaries of the state or Indian Country, as well as to provide technical assistance in managing water resources. Districts are encouraged to look for opportunities to assist in these types of assistance where appropriate and when identified as a state or Tribal priority. Planning Assistance to States negotiations funding is provided to districts for outreach and negotiations for Planning Assistance to States efforts. The non-federal cost share is 50 percent. Section 8119 of WRDA 2022 (PL 117-263) amended 42 USC 1962d–16 to provide for a waiver of fees for eligible economically disadvantaged communities. Fiscal year appropriations for the program are limited to no more than $30 million for comprehensive plans and $30 million for technical assistance. Expenditures are limited to $5 million per year, per state or Indian Tribe for comprehensive plan efforts cumulatively.

(5) Section 729 of WRDA 1986, as amended (33 USC 2267a) authorizes the study of river basins and regions of the United States. Resulting watershed studies may identify ecosystem restoration needs and can lead to detailed feasibility studies conducted in partnership with a sponsor. For more information on the implementation of watershed studies, see ER 1105-2-102.

(6) Section 306 of WRDA 1990 (33 USC 2316) authorizes environmental protection as a primary USACE mission.

(7) Section 204 of WRDA 1992, as amended (33 USC 2326) provides beneficial use authority for USACE to restore, protect, and create aquatic and wetland habitats in connection with construction or maintenance dredging of an authorized project. The authority was amended by Section 207 of PL 104-303to allow for selection of a disposal method that is not the least-cost option. Projects require the consent of the sponsor and determination of reasonable incremental costs. Examples of the application of this authority are benefits to the aquatic environment from creation of wetlands and control of shoreline erosion for the purpose of protecting significant ecological resources using dredged material. The authority has potential applications for new navigation projects as well as maintenance dredging for existing projects. Additional amendments have subsequently modified the authority. For more information on the implementation of USACE's Continuing Authorities Program, see EP 1105-2-58.

(8) Section 206 of PL 104-303, as amended (33 USC 2330), provides continuing authority for aquatic ecosystem restoration and protection for projects that improve the quality of the environment consistent with the public interest and that are found to be cost-effective. Section 210 of WRDA 1999 (PL 106-153) amended the authority to

enable a non-profit entity to sponsor a project with the consent of the affected local government. Section 2020 of WRDA 2007 (PL 110-114) further amended the authority to allow for projects to restore and protect an aquatic ecosystem or estuary. Section 1030(g) of PL 113-121increased the federal cost limit. Section 1149 of WRDA 2018 (PL 115-270) allows for the inclusion of natural or nature-based features, and Section 126 of WRDA 2020 (PL 116-260) includes projects for anadromous fish habitat and passage. For more information on the implementation of USACE's Continuing Authorities Program, see EP 1105-2-58.

(9) Section 210 of PL 104-303, as amended (33 USC 2213), established a standard cost-share for aquatic ecosystem restoration projects. In most cases the federal cost share for ecosystem restoration work is 65 percent.

(10) Section 212 of PL 106-153, as amended (33 USC 2332) provides authority for the Secretary of the Army to implement projects that reduce flood hazards or restore the natural functions and values of rivers and shorelines and that meet other specific criteria without seeking individual authorization for each project. USACE does not currently have appropriations to implement this authority but is conducting studies using other authorities and may seek authorization for projects that meet the goals of this authority. Section 8103 of PL 117-263 amended 33 USC 2332, authorizing the Secretary to cover the first $200,000 of the costs to study these projects.

(11) Section 104 of the Estuaries and Clean Waters Act of 2000, as amended (33 USC 2903) provides authority for the Secretary of the Army to carry out estuary habitat restoration projects and provide technical assistance. 33 USC 2902 defines estuaries to include the Great Lakes.

(12) Section 2039 of PL 110-114, as amended (33 USC 2330a) requires the development of monitoring plans for all ecosystem restoration projects. Monitoring plans require a description of activities and criteria for restoration success. Section 1161 of WRDA 2016 (PL 114-322) amendments to 33 USC 2330a and guidance allow for operations and maintenance (O&M) activities on nonstructural and nonmechanical components of an ecosystem restoration project to cease ten years after the date when ecosystem restoration success is determined. See ER 1105-2-103, paragraph 6-8.e.

(13) Section 1011 of PL 113-121, as amended (33 USC 2341a) established three criteria for the Secretary of the Army to use in prioritizing funding for authorized ecosystem restoration projects. The criteria are to address an identified threat to public health, safety, or welfare; to preserve or restore ecosystems of national significance; or to preserve or restore habitats of importance for federally protected species, including migratory birds; and for which the restoration activities will contribute to other ongoing or planned federal, state, or local restoration initiatives.

(14) Section 1184 of PL 114-322, as amended (33 USC 2289a) requires consideration of certain measures in flood risk management, coastal storm risk management, and ecosystem restoration feasibility studies. The measures to be considered are natural features, nature-based features, nonstructural, and structural measures. The consideration of these measures requires the consent of the non-federal sponsor.

(15) Section 125 of PL 116-260 (33 USC 2326g) establishes a National policy to maximize beneficial use of dredged material. in an environmentally acceptable manner, of suitable dredged material obtained from the construction or operation and maintenance of water resources development projects.

Chapter 3
Fundamentals of aquatic ecosystem restoration planning

3–1. Overview

USACE ecosystem restoration projects will be formulated within USACE authorities (chapter 2) and following Civil Works policies (ER 1105-2-103).

3–2. Aquatic ecosystem restoration objective

The objective of Civil Works ecosystem restoration is to restore degraded ecosystem structure and function to a less degraded, more natural condition. Partial restoration may be possible with valuable improvements made to degraded ecological resources. Restoration opportunities associated with wetlands, riparian, and other floodplain and aquatic, marine, estuarine, lacustrine, wetland, and riverine systems (including riparian areas and floodplains) are most appropriate for USACE involvement.

a. Improving or re-establishing the structural components and the functions of the natural area should be examined. Restored ecosystems should mimic, as closely as possible, conditions that would occur in the area in the absence of human changes to the landscape and hydrology. Restored ecosystems may also mimic, as closely as possible, conditions which could occur in the area if the area has had an equilibrium shift (unable to restore to previous habitat) but still are improvements in the current landscape and hydrology.

b. Indicators of ecological success in Civil Works aquatic ecosystem restoration projects should be included to ensure the restored area continues to function and produce desired outcomes with minimal human intervention. Ecological success indicators should be developed to address project objectives and link to the monitoring and adaptive management plans for a given ecosystem restoration project. Success indicators may include structural characteristics (for example, canopy cover, depth, connectivity), processes (for example, biogeochemical cycling and pollutant removal that improves water quality), or biodiversity (for example, the number or composition of target species). Success indicators must be able to be monitored, measured, and documented.

3–3. Systems planning

Restoration projects should be planned in a systems context and consider aquatic (including marine, estuarine, lacustrine, and riverine), wetland and terrestrial complexes, as appropriate, to improve the potential for long-term persistence as self-regulating, functioning systems. This system view will be applied both in examination of the problems and the development of alternative means for eliminating or reducing those stressors to improve ecosystem structure and function.

a. Consideration should be given to the interconnectedness and dynamics of natural systems, along with human activities in the landscape, that may influence the results of restoration measures. Projects to restore ecological resources may be

recommended based on the monetary and non-monetary benefits anticipated from the measures recommended.

b. Ecosystem restoration plans can be included as part of multipurpose plans, which can produce both economic and environmental outputs. The planning for ecosystem restoration objectives is essentially the same as for other water resources development purposes. However, there are some special considerations because of limitations in understanding the complex interrelationships of the components of ecological resources and services, and because the environmental outputs considered in the evaluation process are typically not monetized.

c. The consideration of significant resources and significant effects is integral to plan formulation and evaluation for water resources development projects. In ecosystem restoration planning, the concept of significance of outputs plays an especially important role because of the challenge of addressing non-monetized benefits.

3–4. Mitigation

Ecosystem restoration projects should be designed to avoid the need for fish and wildlife mitigation (measures taken to avoid, minimize, rectify, reduce, or compensate for adverse environmental impacts).

a. Projects implemented using ecosystem restoration authorities may not be used as wetland banks or mitigation credit for other entities. Feasibility studies may consider joint ecosystem restoration and mitigation banking projects, as long as USACE's financial participation in the project is limited to the ecosystem restoration element.

b. Additional considerations may be needed to comply with the Endangered Species Act (16 USC 1531 et seq.) including the need for mitigation measures in some cases. Any measures that the USACE adopts to implement these responsibilities will be within USACE legal authorities, consistent with USACE missions and responsibilities, and feasible from both a technological and economic point of view. High-cost species or habitat mitigation may be required to comply with the Endangered Species Act but should be closely coordinated with the resource agencies and the vertical team to ensure policy compliance.

3–5. Public interest

For projects where the majority of the physical restoration will occur on land in the ownership of a single firm, individual, club, or association with restrictive membership requirements, it must be demonstrated clearly that the restoration benefits are in the overall public interest consistent with the federal objective (paragraph 4–1.b) and that the benefits do not accrue primarily to the property owner.

3–6. Land acquisition

Land acquisition in ecosystem restoration plans must be kept to a minimum. Projects that consist primarily of land acquisition are not appropriate. Projects where land

acquisition costs are a significant portion (35 percent and above) of the total project cost are not likely to be given a high priority for budgetary purposes.

a. A non-federal sponsor may voluntarily waive reimbursement of lands, easements, rights-of-way, relocations, and disposal areas (LERRD) valued in excess of its cost share. If a project is not land intensive and is policy compliant in all other aspects, but the estimated LERRD value exceeds 25 percent of the total project costs (for example, due to high land values), a project may nonetheless be considered to be policy compliant if the non-federal sponsor provides a letter of intent to voluntarily waive reimbursement for the value of LERRD that exceeds the non-federal sponsor's percentage share of total project costs. If the non-federal sponsor provides the necessary letter of intent, the decision document must clearly describe that the non-federal sponsor has voluntarily agreed to waive reimbursement for the value of LERRD above its percentage share of total project costs, and the project partnership agreement must contain provisions for implementing the concept.

b. Notwithstanding that the non-federal sponsor has agreed to such a waiver, compliance with the following principles must continue:

(1) The project must be formulated so that only the real property interests necessary to implement the project and reasonably assured benefits sufficient to justify the project are required for the project.

(2) The estimated value of all LERRD must be considered as economic costs in the evaluation of alternatives; and,

(3) The non-federal sponsor must comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646), as amended, and implementing regulations (ER 405-1-12), for all LERRD that must be acquired to implement the project.

3–7. Water quality

Water quality is an important component of ecosystem structure, and good water quality is generally integral to healthy functioning ecosystems. An important USACE contribution in rehabilitating ecosystems, where water characteristics are a critical structural component of those ecosystems, may involve improvement of water quality characteristics using engineering solutions. USACE restoration and protection projects may involve cost effective solutions to improve aeration, temperature, turbidity, acidity, salinity, sedimentation, and other water quality parameters. The restoration or creation of wetlands and riparian areas may contribute to these improvements.

a. Consideration should be given to whether the water quality improvements will accomplish restoration of the system, because in many instances, other functional or structural ecosystem components may require attention as well. Projects should not be formulated solely for the purpose of water quality improvement, but teams may formulate plans that include water quality improvements that contribute to ecosystem restoration objectives.

b. USACE will not propose, for Civil Works implementation, any restoration projects or features that would result in treating or otherwise abating pollution problems caused by other parties where they have, or are likely to have, a legal responsibility for remediation or other compliance, including situations where a consent decree is in place. Urban treatment wetlands and remediation of impacts for other responsible parties are not appropriate for USACE involvement.

3–8. Recreation

Recreation features considered as part of ecosystem restoration projects should be appropriate in scope and scale to the opportunity provided by the restoration project. Recreation development and anticipated use must be compatible with the aquatic ecosystem restoration purpose of the project. The recreation potential may be satisfied only to the extent that recreation does not significantly diminish the ecosystem outputs that justify the ecosystem restoration project.

a. Recreation development should not require acquisition of additional lands and should be ancillary to restoration benefits. Recreation facilities, such as parks, may provide buffers for adjacent restoration sites, especially in urban settings.

b. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem restoration project if the separable costs of such facilities are justifiable by the recreation benefits, but the overall project cannot be specifically formulated for a recreation purpose.

c. The level of financial participation in recreation development by USACE at an otherwise justifiable project may not increase the federal cost of the ecosystem restoration project by more than ten percent without prior approval of the ASA(CW). This should be viewed as an upper limit on federal cost sharing and not as a goal for expenditures.

d. A list of approved facilities for ecosystem restoration projects is available in ER 1165-2-400.

3–9. Monitoring and adaptive management

a. The recommended plan for an ecosystem restoration project (or component of a project) must include a plan to monitor restoration success. The cost of monitoring and adaptive management is an important consideration in evaluating alternative plans. The following guidance applies to feasibility reports and post-authorization change reports that require additional Congressional authorization. Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance and determining whether ecological restoration success has been achieved or if adaptive management is needed to attain the intended project results under the restoration objectives.

b. The authority to perform monitoring and adaptive management must be expressly stated in the authorizing legislation or in the authorizing document for the project.

c. Development of a monitoring plan will be initiated during the plan formulation process and should focus on key indicators of project performance relative to restoration objectives. The monitoring plan must be included in the final decision document and must include the rationale for monitoring, the key physical and/or biological parameters to be monitored, methods for measuring the parameters, the relation of the metrics to determining whether the objectives of the ecosystem restoration project have been achieved and to ascertain whether adaptive management will be necessary to achieve those objectives. The monitoring plan should include the ecological restoration success criteria, the periodicity and expected duration of monitoring, the preparation and distribution of monitoring reports and other coordination requirements, and the estimated cost of implementing the monitoring plan.

(1) Monitoring plans do not need to be complex, and the scope and duration should be limited to the minimum monitoring actions necessary to evaluate ecological restoration success. The appropriateness of a monitoring plan will be reviewed as part of the decision document review including agency technical review and independent external peer review, if applicable.

(2) The estimated cost of the proposed monitoring plan will be included in the project cost estimate and cost shared as a construction cost. Monitoring activities that are mainly for research purposes should not be funded with project construction funds.

(3) During the design and construction phases, additional detail may be added to the approved monitoring plan. The monitoring plan will be finalized prior to the completion of construction.

d. Monitoring will be initiated upon completion of physical construction of an ecosystem restoration project (or a functional portion of a project) and will be continued until ecological restoration success has been achieved. After ecological restoration success has been documented by the District Engineer in consultation with the federal and state resource agencies, and a determination has been made by the Division Commander that ecological restoration success has been achieved, no further monitoring will be required.

e. Ecological restoration success will be determined through comparison of the intended ecological structure and function, as defined by ecological restoration success criteria specified in the approved monitoring plan, with the monitoring results. Metrics used in project planning may be used to evaluate ecological restoration success if the metrics are technically appropriate and cost efficient for use in monitoring. Ecological restoration success means that the physical and/or biological developments of the restoration project have progressed on a trajectory and at a rate sufficient to assure that the restoration objectives will be reached within an acceptable timeframe. The determination of ecological success may occur before the expected maximum or

equilibrium level of project outputs is reached, particularly for habitat types that require long periods for full biological development.

f. Required monitoring for a period not to exceed ten years will be funded and cost shared as a project cost. Monitoring periods of less than ten years are allowed if sufficient to make a determination of ecological restoration success. Quality control for plant establishment and other construction contract requirements are not monitoring costs. Costs for monitoring beyond a ten-year period will be a non-federal responsibility. Cost-shared monitoring costs cannot increase the federal or total cost above authorized limits for projects.

g. An adaptive management plan will be developed for each ecosystem restoration project and be included in the decision document. The adaptive management plan must be appropriately scoped to the scale of the project. If specific actions to modify project elements are likely to be needed because of high uncertainty in achieving the intended results, the nature and cost of such actions should be explicitly described in the plan, as well as the triggers to implement each adaptive management action. The reasonableness and cost of the adaptive management plan will be reviewed as part of the decision document. Costly adaptive management plans may indicate the need to reevaluate the formulation of the ecosystem restoration project.

(1) Monitoring results will be used by the district in coordination with federal and state resource agencies and the division to guide adaptive management decisions on operational or structural changes that may be needed to ensure that the ecosystem restoration project meets the ecological restoration success criteria.

(2) The cost of adaptive management should be shown in the 06 Fish and Wildlife Facilities feature code of the cost estimate. Also see ER 1110-2-1302, paragraph 12, for more details.

h. If, during the first ten years after construction, the District Engineer determines adaptive management changes are necessary, the non-federal sponsor must concur with the changes, which will be cost-shared with the non-federal sponsor as project costs.

(1) The appropriate USACE Headquarters elements should be advised when it is determined that an adaptive management change to a project is required and if the costs increase above established thresholds for discretionary cost approvals, a change control board and ultimate approval by the Deputy Commanding General for Civil and Emergency Operations may be required.

(2) Any proposed changes to the adaptive management plan approved in the decision document must be coordinated with the USACE Headquarters Chief of Planning and Policy Division at the earliest possible opportunity. If a needed change is not part of the approved adaptive management plan and is determined by Chief of

Planning and Policy Division to be a deficiency correction, districts should follow the annual budget guidance to initiate a study for such corrections.

(3) Significant changes to a project that are required to achieve ecological restoration success, and that cannot be appropriately addressed through operational changes or through the approved adaptive management plan, may need to be examined under other authorities, such as Section 216 of the Flood Control Act of 1970 (33 USC 549(a)).

i. For technical advice regarding the preparation of monitoring and adaptive management plans, consult with the Ecosystem Restoration National Planning Center of Expertise and refer to Engineer Research and Development Center (ERDC) Technical Guide ERDC/EL SR-19-9.

3–10. Real estate considerations

The analysis of the nature and extent of real estate requirements must be conducted consistent with Chapter 12 of ER 405-1-12, including consideration and identification of the specific interests, estates, and acreage required. After coordination and consultation with the non-federal sponsor, the Federal Government will determine the LERRD required for the implementation, operation, and maintenance of the project.

a. Generally, fee title is required for ecosystem restoration projects, consistent with ER 405-1-12. An easement estate may be appropriate based on the interest required for the implementation, operation, and maintenance of the project. If an estate less than fee is recommended, consideration should be given to the preservation of the physical integrity of the restoration project and to risks associated with achieving benefits that serve to justify the project cost. Exemptions from using a standard estate can only be granted by the USACE Headquarters Director of Real Estate.

b. A real estate plan prepared consistent with the requirements of Chapter 12 of ER 405-1-12 must be included in the feasibility report or other decision document. The level of detail required will vary depending on the project’s scope and complexity.

3–11. Projects on other federal lands

Section 1025 of PL 113-121 provides discretionary authority to the Secretary to carry out an authorized water resources development project on federal land that is under the administrative jurisdiction of another federal agency, where the cost of acquisition of such federal land has been paid for by the non-federal sponsor. The Secretary may carry out such a project only after the non-federal sponsor has entered into a Memorandum of Understanding with the federal agency with administrative jurisdiction over such federal land, which includes such terms and conditions as the Secretary determines to be necessary. This section does not alter any non-federal cost-sharing requirements.

a. During the feasibility phase of a proposed project, if it is determined that project features will be carried out on lands under the administrative jurisdiction of another federal agency (or agencies, as applicable), for which the non-federal sponsor has paid for the acquisition of those lands, the Major Subordinate Command will submit supporting documentation to the appropriate Headquarters element. The supporting documentation will be reviewed by the USACE Headquarters Chief of Planning and Policy Division, Director of Real Estate, and the Chief Counsel. Upon determination that the submittal meets the requirements outlined below and is legally sufficient, USACE Headquarters Director of Civil Works will make a recommendation regarding project implementation on such federal lands to the ASA(CW) for consideration.

b. The supporting documentation submittal will include:

(1) documentation of the non-federal sponsor's payment to acquire the federal lands that will be used for the project;

(2) confirmation from the other federal agency that proposed project lands were acquired by the non-federal sponsor;

(3) a letter of support from the appropriate management level of the other federal agency which indicates their intention to sign the Memorandum of Understanding;

(4) a copy of the draft Memorandum of Understanding;

(5) the district's analysis of the other federal agency's participation in the project;

(6) a discussion of the project related benefits that will be realized on those lands;

(7) a discussion of the circumstances which make USACE the appropriate federal agency to implement and cost share the actions;

(8) an explanation of the environmental and other compliance obligations and costs (such as for the Clean Water Act (33 USC 1251 et seq.), the Endangered Species Act, and the National Historic Preservation Act (54 USC 300101 et seq.)); and

(9) a determination of the responsible agency for fulfilling those compliance requirements on the federal lands, including compensatory mitigation activities.

c. Upon approval by ASA(CW) that USACE may carry out the proposed project on federal lands under the administrative jurisdiction of another federal agency, the final feasibility report will document USACE implementation and cost-sharing of such features. The Items of Local Cooperation in the final report will be reviewed to determine if revisions or additional language is needed. The report of the Chief of Engineers will recommend Congressional authorization for USACE to implement the recommended plan on other federal agency lands.

3–12. Operation and maintenance

Self-regulation is a key goal of ecosystem restoration. It is generally more desirable to pursue restoration projects that have limited maintenance requirements. However, there will be instances where operation and maintenance (O&M) measures may be essential to the long-term functioning of the restoration project. O&M costs should be included in evaluating the costs and benefits of alternatives for ecosystem restoration projects.

3–13. Ending operation and maintenance

Ten years after ecological success has been determined, the responsibility of a non-federal sponsor to conduct O&M activities on nonstructural and nonmechanical elements of an ecosystem restoration project (or component of a project) will cease. (33 USC 2330a)

a. Operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of structural and mechanical elements of an ecosystem restoration project (or component of a project) will continue as outlined in the project operations manual. The manual should be developed in concert with the sponsor and provided to the sponsor to execute after construction. Plans for OMRR&R should be comprehensive and include all commitments needed to operate the project. This may include environmental management commitments under laws such as the Endangered Species Act, the Migratory Bird Treaty Act, and other environmental and conservation laws.

b. The decision document for an ecosystem restoration project, or for other projects with an ecosystem restoration component, will include a description of project features that are considered nonmechanical and nonstructural.

c. The decision document will analyze the long-term risk to ecological success and sustainability of project features and functions. The risk analysis should compare sustainability scenarios with O&M of nonmechanical and nonstructural elements occurring in perpetuity versus O&M ending after the prescribed time frame. The significance of risks (including those from invasive and/or exotic species) associated with the cessation of O&M of nonmechanical and nonstructural elements at an ecosystem restoration project (or component of a project) will be considered during deliberations on plan selection and federal participation.

3–14. Levee setbacks

Army policy is to encourage floodplain restoration, as it encourages community resilience and provides benefits to both the ecosystem and human well-being. The use of levee setbacks, along with other measures to increase and enhance floodplains, is encouraged in aquatic ecosystem restoration projects. It is also Army policy not to increase flood risks or decrease life safety without sufficient justification. (See Department of the Army (DA), ASA(CW) memorandum (Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) Nooksack River Delta Setback Levees – Policy Concurrence), 26 May 2016.) When formulating restoration projects that propose restoring floodplains, USACE should use the existing level of flood risk as the

formulation baseline. If any changes to the baseline are recommended, then USACE should demonstrate the rationale for the increase or decrease in the level of flood risk management. If the level of flood risk associated with an ecosystem restoration project is decreased, then the risk reduction increment above the baseline must be cost effective and incrementally justified. If the level of flood risk is increased because of ecosystem restoration, then USACE must mitigate any induced damages as part of the project.

3–15. Federal Aviation Administration coordination

Projects must not significantly increase wildlife risks to aviation and human safety. Planners are encouraged to initially identify all military or civilian airports located within 10-miles of a project area and to notify the Federal Aviation Administration (FAA) and the base commander that a water resources project investigation is beginning and invite the FAA and the base commander to be a cooperating agency. Projects that have a military or civilian airport within a 5-mile radius must be fully coordinated with the FAA and the base commander, and documentation of this coordination must be included in the feasibility report following Federal Aviation Administration Advisory Circular 150/5200-33.

3–16. Indigenous Knowledge

Office of Science and Technology Policy and Council on Environmental Quality memorandum (Indigenous Traditional Ecological Knowledge and Federal Decision Making), 15 November 2021, encourages federal agencies to consider, where available, Indigenous Knowledge throughout the planning process. Office of Science and Technology Policy and Council on Environmental Quality memorandum (Guidance for Federal Departments and Agencies on Indigenous Knowledge), 30 November 2022, provides an overview of Indigenous Knowledge as a system of knowledge and provides examples of applying the body of Indigenous Knowledge to agency processes and decisions. The identification of Indigenous Knowledge is accomplished through Tribal consultation and collaboration with all appropriate Tribal and project delivery team offices and experts, in accordance with accepted protocols (DA, ASA(CW) memorandum (Updated U.S. Army Corps of Engineers Civil Works Tribal Consultation Policy), 5 December 2023)). As part of early Tribal consultation, there should be an initial discussion regarding the availability of Tribal information and knowledge that would be relevant. As the study progresses, continued consultation and collaboration should identify and consider Indigenous Knowledge to improve study decision-making. Indigenous Knowledge may inform all aspects of a study, including resource significance, species and habitats, cultural resources, traditional cultural places, water resources, and hydrology.

3–17. Federal and non-federal participation

a. Cost sharing. For specifically authorized aquatic ecosystem restoration projects, the costs of the feasibility phase are shared equally with the non-federal sponsor. (See 33 USC 2215.) The non-federal share will be 35 percent of the project or separable element implementation costs (preconstruction engineering and design, construction), or total implementation costs of a multiple purpose project allocated to ecosystem restoration. (See 33 USC 2213.) Non-federal sponsors will provide 100 percent of LERRD. The value of LERRD will be included in the non-federal 35 percent share. A non-federal sponsor may choose to voluntarily waive reimbursement for the value of LEERD which exceeds their 35 percent share. The non-federal sponsor will provide 100 percent of project OMRR&R.

b. Coordination and collaboration. In identifying ecosystem restoration opportunities, districts will seek the advice and cooperation of federal, state, and Tribal resource agencies, as well as input from interested non-governmental environmental organizations and the public. The assistance of these agencies and other interests should be used to identify the boundaries and parameters of the ecosystem, or portions thereof; prioritize ecosystem restoration needs reflecting national and regional priorities; identify the existing condition and without-project future condition of selected ecosystem(s), or parts thereof; and define the restoration goals and objectives.

Chapter 4
Planning procedures

4–1. Planning process

a. Watershed context. Consideration of ecosystems within (or encompassing) a watershed provides a useful organizing tool to approach ecosystem-based restoration planning. Aquatic ecosystem restoration projects that are conceived as part of a watershed planning initiative or other regional resources management strategy, may be likely to meet ecosystem management goals more effectively than independently developed projects and decisions. Independently developed ecosystem restoration projects, especially those formulated without a system context, may only partially and temporarily address symptoms of a chronic systemic problem. Not all restoration studies will be “watershed studies,” but all USACE studies should have a watershed perspective.

b. Federal objective in aquatic ecosystem restoration planning. The Federal objective in ecosystem restoration planning is to contribute to national ecosystem restoration. Contributions to national ecosystem restoration are increases in the net quantity and/or quality of desired improvements of structure, function, and services of ecosystem resources. Measurement of national ecosystem restoration is based on changes in ecological resource quality, generally habitat quality. The recommended plan ordinarily is the alternative having the maximum excess of monetary and non-monetary beneficial effects over monetary and non-monetary costs. This plan occurs where the incremental beneficial effects just equal the incremental costs, or alternatively stated, where the extra ecosystem value is just worth the extra costs. This plan should be called the National Ecosystem Restoration (NER) plan.

c. Six-step planning process. Civil Works planning for the aquatic ecosystem restoration mission follows the six-step planning process discussed in ER 1105-2-103 and defined in the Economic and Environmental Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G). The planning process as it applies to ecosystem restoration projects is summarized in the subsequent paragraphs.

4–2. Planning step one: identify problems and opportunities

a. Problems and opportunities. Problems and opportunities should be defined in terms of their nature, cause, location, dimensions, origin, time frame, and importance. A clearly defined problem statement and concise opportunity descriptions are essential to orienting the focus of an aquatic ecosystem restoration study.

b. Objectives and constraints. Planning teams develop objectives and constraints based on the study area problems and opportunities. Developing specific, flexible, measurable, realistic, attainable, and acceptable objectives is critical to the success of the entire planning process. Planning objective statements should include subject, effect, location, timing, and duration. The primary objectives of an ecosystem restoration study should be directly connected to the USACE aquatic ecosystem restoration

mission and the realization of Environmental Quality benefits. Planning constraints identify actions or outcomes to avoid in developing plans aimed at meeting study objectives and addressing problems and opportunities.

4–3. Planning step two: inventory and forecast conditions

a. Inventory of existing conditions and forecast of future conditions. Both existing conditions and future conditions expected to occur without a project must be characterized. The future without-project condition forms the basis from which alternative plans are formulated and impacts are assessed over the period of analysis.

b. Assessing conditions. Gathering information about historic and existing resources requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in environmental conditions are likely to impact problems and opportunities. Forecasting future ecosystem conditions may be subjective and can be very difficult, but forecasting is essential to formulating restoration projects. Forecasting should be done in an iterative manner, seeking input from Tribes, the state, federal resource agencies, and the environmental community to help build consensus about future without-project conditions and what outputs the restoration project will produce. Forecasting may be especially critical to a case for protection where an argument must be made that there will be a decline or degradation of the resource unless protection is provided.

(1) Many methods and models are available to measure ecosystem resource conditions and to estimate future conditions. Habitat models for individual species may have limitations when used to assess ecosystem restoration problems and objectives. They do not consider communities of organisms and typically consider habitat in isolation from its ecosystem context. Single species habitat models may be limiting if used to optimize for a particular species, but they can be useful when carefully applied in the ecosystem context in which the habitat is situated. Single species habitat models can be helpful in identifying important influential functions or structural components for projects to address.

(2) The assessment methodology chosen should be governed by how well the technique meets the needs of the goals and objectives and the level of detail for the study. The methodology may include habitat models or information derived from community or ecosystem assessments using other scientifically based methods that are generally accepted by state or federal resource agencies.

(3) Ecosystem restoration studies must include a conceptual model to represent ecosystem processes and characteristics (the structure, functions, and services anticipated to be produced by the restoration project). The conceptual model explains how ecological conditions related to identified problems are expected to change under the future without-project conditions and how measures or alternatives would alter future ecological processes and conditions. Conceptual models are also used to guide the development of monitoring plans. Conceptual models are qualitative, may be

graphical and/or narrative, and do not require certification. For technical advice regarding conceptual models, refer to ERDC/EBA TN-08-1.

4–4. Planning step three: formulation of alternative plans

a. Plan formulation consists of five activities:

(1) Identifying management measures;

(2) Preliminary screening of management measures;

(3) Developing plan formulation strategies;

(4) Formulating alternatives by combining compatible management measures; and

(5) Iterative reformulation, during which alternative plans previously formulated are changed for one or more reasons.

b. Measures may be added, dropped, re-scaled, or otherwise modified such that the reformulated plan will better achieve a planning objective or stay within the limits of a constraint.

4–5. Planning step four: evaluation of alternative plans

The evaluation of plan effects may be the single biggest challenge in ecosystem restoration planning because of the inability to quantify ecosystem benefits using monetary metrics. Procedures for evaluating ecosystem restoration alternative plans are described in the following paragraphs. These procedures include the use of cost effectiveness and incremental cost analysis (CE/ICA), documenting the significance of ecosystem outputs, evaluation of the four criteria in the P&G, and assessing the risk and uncertainty of restoration plans.

a. Methods. The evaluation of effects is a comparison of the without-project and with-project conditions for each alternative. At a minimum, two categories of effects will be evaluated: costs and outputs. Ecosystem outputs are the desired or anticipated measurable products or results of restoration measures and plans. The term “outputs” is often used interchangeably with “benefits.” Restoration proposals may possess multiple output categories, as well as other effects that may need to be considered, but the evaluation must address cost and an output category that has been determined to reasonably represent ecosystem restoration benefits. Evaluations assess or measure the differences between each with- and without-project condition and then appraise those differences (for example, how important are the differences?). Evaluation consists of four general tasks:

(1) Forecast the most likely with-project conditions expected under each alternative;

(2) Compare each alternative's with-project conditions to the without-project conditions and document differences between the two;

(3) Characterize the beneficial and adverse effects by magnitude, location, timing, and duration; and

(4) Qualify plans for further consideration.

b. Evaluation criteria. All USACE water resources development projects must be evaluated in terms of the four P&G criteria: completeness, efficiency, effectiveness, and acceptability. Ecosystem restoration alternatives that are determined to be both complete and acceptable are evaluated using CE/ICA for comparison in terms of effectiveness and efficiency.

c. Model review. If an output metric used in the CE/ICA is derived from a model, the planning model must be certified or approved consistent with applicable guidance. Output metrics should be indicative of or linked to ecosystem restoration planning objectives. Metrics that encompass both the quantity and quality of ecological outputs, or that estimate populations of indicator species within a defined area, are generally appropriate. Output metrics should capture aquatic ecosystem restoration benefits and be consistent with USACE restoration policies. Model and metric selection should be coordinated with the Ecosystem Restoration National Planning Center of Expertise early in the process.

4–6. Cost effectiveness and incremental cost analyses

In ecosystem restoration planning efforts CE/ICA is used in the evaluation of alternative plans. CE/ICA are two distinct analyses that must be conducted to evaluate the effects of alternative plans.

a. Cost effectiveness. It must be shown through CE analysis that an alternative restoration plan's output cannot be produced more cost effectively by another alternative. "Cost effective" means that, for a given level of non-monetary output, no other plan costs less, and no other plan yields more output for less money.

b. Incremental cost analysis. Subsequently, through ICA, a variety of implementable alternatives and various-sized alternatives are evaluated to arrive at a "best" level of output within the limits of both the non-federal sponsor's and the USACE's capabilities.

c. Best Buy plans. The subset of cost-effective plans is examined sequentially (by increasing scale and increment of output) to ascertain which plans are most efficient in the production of ecosystem benefits. Those most efficient plans are called "Best Buys." They provide the greatest increase in output for the least increase in cost. When compared with all other plans producing as much or more output, a "Best Buy" plan has the lowest incremental costs per unit of output. In most analyses, there will be a series of "Best Buy" plans, in which the relationship between the quantity of outputs and the

unit cost is evident. As the scale of “Best Buy” plans increases, average costs per unit of output and incremental costs per unit of output will increase.

d. Other considerations. Usually, the ICA alone will not point to the selection of any single plan. The ICA results must be synthesized with other decision-making criteria (for example, significance of outputs, effectiveness, risk and uncertainty, and reasonableness of costs) to help the team select and recommend a particular plan.

e. Degree of sophistication. There are several ways of conducting CE/ICA, thereby determining which plans are cost effective, and, from the set of cost-effective plans, identifying those plans which are most efficient in production (that is Best Buy plans). In relatively uncomplicated cases, these analyses may simply be in a table. In slightly larger or more complex situations, user-built and generated spreadsheet models may suffice. In still larger and more involved calculations, planners may need to use more sophisticated software applications specifically designed for CE/ICA. Planners should also avoid displaying costs and habitat units with multiple decimal places. This level of precision is not typically useful in discerning between plans.

f. Institute for Water Resources Planning Suite software. The USACE Institute for Water Resources (IWR) has developed procedures and software to assist in conducting CE/ICA. Refer to IWR Report 94-PS-2 and IWR Report 95-R-1 for detailed discussion of CE/ICA. The IWR Planning Suite is a nationally certified software package available to assist in performing CE/ICA. These reports and the IWR Planning Suite software package are available from the IWR website, https://www.iwr.usace.army.mil/.

g. Cost effectiveness and incremental cost analysis procedures.

(1) Before starting CE/ICA, the planning team should identify potentially implementable plans for achieving the desired ecosystem outputs. Describe plans in terms of their effects on costs and outputs. Develop an estimate of the cost of the alternative and an estimate of the ecosystem output it will produce. Calculate all costs in terms of present worth using the appropriate discount rate and annualize. Ecosystem restoration outputs are not discounted, but should be computed on an average annual basis, taking into consideration that the outputs achieved are likely to vary over time. The output values listed are the differences between with- and without-project conditions, not total values before and after the project is implemented. The management measures, scales, costs, and outputs should then be listed.

(2) After estimating the costs and outputs of each solution, the next step is to formulate combinations of management measures and scales. Each possible combination may be considered an alternative plan. In cases with a limited number of measures identifying all combinations may be manageable. Teams should be reasonable in describing a distinct array of alternatives but should not be obligated to have a comprehensive listing of all possible combinations of measures and scales. A suite of 20 measures could be potentially combined into over a million different plan combinations. While software can assist teams in making these combinations, the ability of teams to comprehend differences between this many plans is challenging and

burdensome. Measures that may not meet objectives or that would otherwise face implementation issues should be pre-screened. Carefully defining measure compatibility can reduce the number of alternative plan combinations. Developing plan formulation strategies can also help teams develop distinctly different alternatives composed of suites of management measures to meet planning objectives, without the burden of assembling myriad combinations of management measures.

(a) By definition, scales within a management measure are mutually exclusive; they represent the application or implementation of different amounts of a given management measure.

(b) When measures and scales are combined, the cost and output of each part of the combination is summed. Each combination thus has an associated total cost and total output.

(3) The next step is to sort alternatives in terms of increasing output. This is done before CE analysis. Costs and outputs of combined solutions may be additive or synergistic or redundant. It is important to document the rationale for determining which of these cases applies.

(4) Once alternative plans have been formulated and sorted by increasing output, the next step is conducting CE analysis. Cost effective means that, for a particular level of output, no other plan costs less and no plan yields more output for the same or less cost.

(a) Graphing cost-effective plans in terms of their respective costs and outputs can help visually display the relationship between the increasing financial investment required for increasing ecosystem outputs.

(b) Each of the cost-effective plans produces its associated level of output at the least cost; no other plan can provide as much output for the same level of investment. This is an important point to make in ecosystem restoration evaluations, and an important criterion in qualifying plans for further evaluation.

(5) The next step examines the efficiency of each of the cost-effective plans, which is accomplished through ICA. In incremental cost analysis those cost-effective plans that are most efficient in production are identified. These plans, known as “Best Buy” plans, provide the greatest increase in output for the least increase in cost. They have the lowest incremental costs per unit of output. The concept of incremental changes in costs and outputs is analogous to the concept of marginal changes (the differences in cost or output between one plan or alternative and the next one in succession).

(a) The decision rule in incremental analysis is to select the plan with the lowest cost per unit (the first “Best Buy” plan which produces output at the lowest unit cost) and then remove from consideration (in this analytical process) any plans that provide a smaller output level than the lowest cost per unit plan because they are less efficient in production, producing a lower level of output at a higher unit cost.

(b) To conduct ICA, start with the subset of cost-effective plans ranked by increasing output. Beginning with the “no action” alternative, compute the incremental cost, incremental output, and incremental cost per unit of incremental output advancing from the no action alternative to each successive alternative. The incremental cost is the additional cost incurred in selecting one plan over another, or in this case the difference in cost between each alternative and the no action alternative. Similarly, the incremental output is the additional output gained in selecting one plan over another, or in this case the difference in output between each alternative and the no action alternative. The incremental cost per unit of incremental output is the incremental cost divided by the incremental output. It shows the change in cost from the no action alternative to each other alternative plan on a per unit basis. The cost-effective plan with the lowest incremental cost per unit of incremental output is the first Best Buy plan.

(6) Recalculate the incremental cost per unit of incremental output of implementing each remaining cost-effective plan compared to the first Best Buy plan (not including the no action plan). The alternative plan with the lowest incremental cost per unit of incremental output of all remaining plans is the second Best Buy plan (it has the second lowest incremental cost per unit of incremental output of all cost-effective plans).

(a) This process of recalculating incremental cost per incremental unit of output for each remaining plan over the last selected “Best Buy” plan is repeated until the incremental unit cost for the last remaining plan has been recalculated. The number of iterations is dependent upon the number of cost-effective plans and on the respective cost and output data of each.

(b) The iterative process of selecting successively larger “Best Buy” plans is a decision process based on production efficiency. Situations could arise where the most efficient plan produces such a large quantity of output that its total cost makes it infeasible due to cost constraints. Because the plan is the most efficient in production, all plans that produce smaller output levels at lower and acceptable cost levels would be eliminated from consideration. It may help to remove such a large-scale plan from consideration and repeat the “Best Buy” iterative process. The purpose of the iterative process is not to eliminate plans from the possibility of being selected, but rather to identify plans where there is a marked increase in production costs. By identifying where significant increases in production costs occur as output levels increase, better information is provided to assist in determining desirable project scale.

(7) The final CE/ICA step is tabulating and graphing the incremental costs.

(a) It is not necessary to display all such iterations in ecosystem restoration report documentation. The study team should provide a table that summarizes the pertinent incremental cost and output information associated with the increasing size (in terms of output) of the “Best Buy” plans.

(b) Graphing the “Best Buy” plans can help visually display the relationship between the increasing financial investment required for increasing environmental outputs. Figure 4-1 shows the incremental average annual equivalent (AAEQ) costs of

alternative plans (in $1000) on the y-axis and the average annual environmental benefits (in average annual habitat units (AAHU)) on the x-axis. A similar figure should be provided in ecosystem restoration reports.

(c) Neither CE analysis nor ICA includes a “one plan” selection rule like the National Economic Development plan selection rule. In the absence of such a decision-making rule, neither analysis dictates which plan is the NER plan. However, the information developed by both analyses can inform decision-making by progressively proceeding through the available levels of output to ask whether the next level is “worth it”; that is, whether the ecosystem benefit of the output in the next level is worth its additional cost. In the example shown in Figure 4-1, the question is whether the first increment of 22 AAHU are worth an AAEQ cost of $440 each, as opposed to the no action alternative of 0 habitat units at $0 each.

(d) If it is judged that 22 AAHU are worth an AAEQ cost of $440 each, then proceed to the next level of output and repeat the questioning. At the next level there is a total of 33 AAHU, or 11 additional AAHU over the last level at a cost of $2,600 for each additional AAHU. Again, if the case can be made that the additional 11 AAHU are worth an AAEQ cost of $2,600 each, then proceed to the next increment.

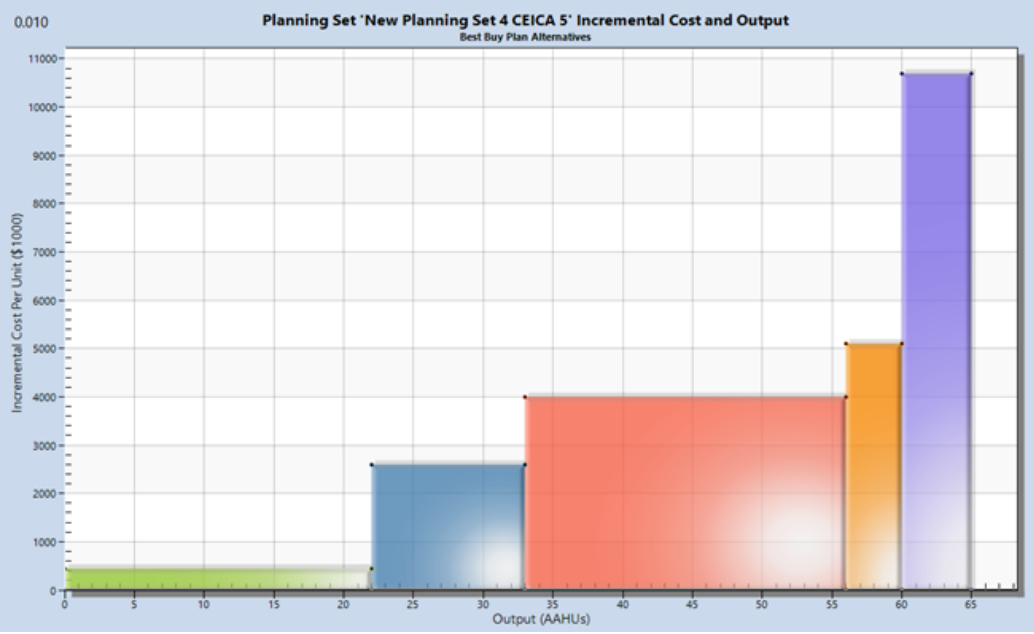

Figure 4-1 “Best Buy” plans

(e) Often this questioning process will tend to continue to conclude that successive levels of output are “worth it” until an unusual increase in incremental costs, beyond the general range of preceding costs, is encountered. In the CE/ICA graph, Figure 4-1, the last increase represents a jump in incremental AAEQ costs of $10,700 per habitat unit for each of the last five habitat units. This doubling of unit cost for additional output (from the preceding increment) most likely presents a situation where the value of

increasing outputs to this level should be explained, supported, or otherwise considered in more detail than previous increases.

(f) These general decision-making considerations related to outputs, costs, and display curves should be applied to CE/ICA results to support the “Is it worth it?” case:

1. *Curve anomalies.* Curve anomalies (abrupt breakpoints, spikes, peaks, jumps, inflection points, or CE/ICA curve changes) identify potential points that give decision-makers reasons to question the causes of the changes, and whether additional incremental costs are worth it.

2. *Output target.* If a study has established a specific resource output target to be met, then a decision rule can be developed to meet some portion of that target. For example, a target could be marked on an incremental cost bar graph to provide a picture of the relationship between the target and possible solutions. The display may be useful in focusing on whether the incremental costs of the solutions leading to the target are worth it.

3. *Output thresholds.* In some cases, it may be necessary to first produce a minimum base amount of output, and any lesser amount would not be successful. Similarly, there may also be a “maximum threshold” level of output where production beyond that output would no longer contribute to the achievement of planning objectives. If minimum or maximum output thresholds exist, they can be used to bound the range of effective and efficient solutions.

4. *Cost affordability.* If implementation funds are a constraint, either from the perspective of USACE or the non-federal sponsor funding limitations, then decision-makers can review the CE and ICA curves for information to help them judge the best investment for the funds available.

5. *Unintended effects*. Decisions to recommend a particular cost effective or “Best Buy” plan are not made in isolation. Other factors that matter in terms of selecting one alternative over another could include, for example, land ownership, effects on other outputs, and effects on nearby stakeholders. It is possible that the unintended consequences could be just as important as the primary project purpose of ecosystem restoration. The importance and magnitude of these unintended effects will of course vary from study to study.

(g) CE/ICA results are intended to help decision makers make better informed decisions. In all but the most unusual cases, the NER plan should be identified from the final set of “Best Buy” alternatives.

(h) Other solutions, identified as non-cost effective in CE analysis; as well as cost-effective plans identified as relatively less efficient in production (“non-Best Buy alternatives”) in incremental analysis, may continue to be considered for selection. In some cases, the economic and environmental models used to estimate the effects of ecosystem restoration plans are not capable of capturing the full range of such effects, or considerable uncertainty may accompany the estimates of such effects. Other

evaluation criteria such as environmental significance, acceptability, completeness, and effectiveness also impact the decision process. For example, concerns about endangered species, support by a local sponsor or other interest group, unintended effects on other economic, social, and ecological resources, and other factors may lead to the continuing consideration and selection of solutions that are cost effective but may incur substantial incremental costs. However, identification of the NER plan should still be based on reasonable maximizing net ecosystem outputs; plans recommended because of other factors unrelated to ecosystem benefits could be considered as either a locally preferred plan or as a non-NER plan but with federal interest based on other public benefits provided.

4–7. Significance of ecosystem outputs

Because of the challenge of dealing with non-monetized benefits, the concept of the significance of outputs plays an important role in ecosystem restoration alternatives evaluation. Along with information from CE/ICA, information about acceptability, completeness, effectiveness, and the significance of ecosystem outputs will help determine whether the proposed investment is worth its cost and whether a particular alternative should be recommended.

a. Contingent value procedures not allowed. Contingent value procedures (survey techniques) for estimating existence, option, bequest, or other such non-use values must not be used due to several factors including the conjectural nature of estimated values and the high difficulty in controlling bias.

b. Resource significance considerations. Restoration projects should address nationally or regionally significant resources. Statements of significance provide qualitative information to help decision-makers evaluate whether the value of the resources of any given alternative are worth the costs incurred to produce them. The significance of restoration outputs should be recognized in terms of institutional, public, and/or technical importance. This means that someone; some entity; some law, policy, or regulation; or some scientific evidence indicates that a particular resource is important. How to determine and characterize institutional, public, and/or technical significance is an important point and explained in greater detail in the paragraphs below. IWR Report 97-R-4 covers procedures for determining and describing the significance of environmental resources.

(1) *Institutional recognition.* Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, Tribes, or private groups. Sources of institutional recognition include: (1) public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal Government; (2) regulations, treaties, plans, resolutions, codes, ordinances, and other policy statements of Tribes with jurisdiction in the planning area; (3) plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; (4) laws, plans, codes, ordinances, and other policy statements of regional and local public entities with

jurisdiction in the planning area; and (5) charters, bylaws, and other policy statements of private groups.

(a) Examples of information sources that can assist in identifying and describing significant resources at the federal level include the threatened and endangered plant and animal species listed under the Endangered Species Act of 1973, as amended; the species lists of the U.S. Fish and Wildlife Service, Office of Migratory Bird Management available on the U.S. Fish and Wildlife Service website; species listed in the Anadromous Fish Conservation Act of 1965 (PL 89-304); species protected by the Marine Mammal Protection Act of 1972 (PL 92-522); the waterfowl habitat areas and habitat joint ventures of the North American Waterfowl Management Plan available on the U.S. Fish and Wildlife Service website; the wetlands designated in the National Wetlands Priority Conservation Plan available on the U.S. Fish and Wildlife Service website; the rivers identified by the National Wild and Scenic Rivers Act of 1968 - Nationwide Rivers Inventory available from the National Park Service; and the estuaries designated under the National Estuary Program listed on the U.S. Environmental Protection Agency's National Estuary Program website.

(b) Examples of sources of regional level information include, but are not limited to, the Louisiana wetlands designated under the Coastal Wetlands Restoration Plan and annual priority project list; the protected areas identified by the Northwest Power and Conservation Council authorized by the Northwest Power Act of 1980 (PL 96-501); the aquatic habitats identified by the Upper Mississippi River System Environmental Management Program authorized by PL 99-662 Section 1103; the marine habitats identified in reports produced under Executive Order 13158; the aquatic resources identified through the Chesapeake Bay Program; and information in the USACE National Shoreline Management Study.

(c) On the state level, information sources may include the species and habitats identified in state natural heritage programs, species listed under state endangered species programs, habitats designated in state wetlands priority plans, marine resources identified in state coastal zone management programs, and habitats identified by state chapters of The Nature Conservancy or other non-governmental entities.

(d) Local level sources may include zoning ordinances, wetlands regulations, master plans, shoreline regulations, and habitat conservation plans.

(2) *Public recognition.* Public recognition means that some segment of the public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for a particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, providing volunteer labor, and correspondence regarding the importance of the resource.

(a) The public expresses recognition of resource significance through membership in local, regional, state, national, and international organizations. The public also expresses recognition through activity participation, including resource-specific activities

(for example, focus on a river, a type of fish, a watershed), user-based activities (for example, fishing, birdwatching, hiking), or conservation or management-based activities (for example, wetlands projects, posting no-wake zones signs, planting seedlings).

(b) Another form of public recognition is the role of the resource in the public's customs and traditions. For example, some communities may hold annual festivals, fairs, and seasonal celebrations in association with a resource that reflects its importance to the community.

(c) Public and agency records (for example, newspaper articles, letters written to USACE) and scoping meetings with the public as well as non-profit organizations with an interest in the resource may help USACE planners identify sources of public recognition of resource significance.

(3) Tribal recognition.

(a) Tribes and Indigenous Peoples hold relevant information and perspectives regarding the environment, and Indigenous Knowledge can inform recognition of resource significance and other planning analysis.

(b) Tribes and Indigenous communities may have special expertise with respect to environmental and community impacts, informed by Indigenous Knowledge. Tribes and Indigenous Peoples may have relevant information about species locations, behaviors, habitats, and changes over time that can be applied, and they may hold relevant information and perspectives regarding the environment and the significance of the resource. For example, in the Pacific Northwest, many Tribal ceremonies revolve around salmon runs, indicating the importance of salmon to the culture and traditions of these Tribes.

(c) Indigenous Knowledge is a body of observations, oral and written knowledge, practices, and beliefs that promote environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems. It is applied to phenomena across biological, physical, cultural, and spiritual systems.

(d) USACE should engage with Indigenous Knowledge only through relationships with Tribal Nations and Native communities and in a manner that respects the rights of knowledge holders to control access to their knowledge, to grant or withhold permission, and to dictate the terms of its application. Should Tribal Nations and Native communities decide to share Indigenous Knowledge and otherwise collaborate with the Federal Government, the Federal Government should ensure that the application of that knowledge and complementary collaborative efforts benefit Tribal Nations, Native communities, the United States, and our planet.

(e) Since Indigenous Knowledge is often unique and specific to a Tribe or Indigenous People, and may exist in a variety of forms, consultation and collaboration with Tribal Nations and Indigenous Peoples is critical to ensuring that Indigenous

Knowledge is considered and applied in a manner that respects Tribal sovereignty and achieves mutually beneficial outcomes for Tribal and Indigenous communities.

(4) *Technical recognition.* Technical recognition means that a resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or assessment of critical resource characteristics. Whether a resource is determined to be significant may vary based on differences across geographic areas and spatial scales. A resource's technical significance may depend on whether a local, regional, or national perspective is undertaken. Typically, a watershed or larger (ecosystem, landscape, or ecoregion) context should be considered. USACE planners should describe technical significance in terms of one or more of the following criteria or concepts.

(a) Scarcity is a measure of a resource's relative abundance within a specified geographic range. Generally, scientists consider a habitat or ecosystem to be rare if it occupies a narrow geographic range (limited to a few locations) or occurs in small groupings. Unique resources, unlike any others found within a specified range, may also be considered significant, as well as resources that are threatened by interference from both human and natural causes.

(b) Representativeness is a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range. The presence of a large number and percentage of native species, and the absence of exotic species, implies representativeness. The presence of undisturbed habitat is another indicator.

(c) The concept of status and trends involves evaluating the occurrence and extent of the resource over time, how it has changed, and why. Documenting the status or health of the resource includes describing its physical attributes, the extent of degradation, and any human alterations. The trends associated with the degradation of the resource should indicate whether the resource is declining, recovering, or maintaining a steady status, as well as how quickly the resource is changing.

1. Different variables may be used to describe the status of the resource and include: the presence of pollution, biodiversity, abundance of distress-loving and exotic species, extent of man-made barriers and other disturbances, and degree and immediacy of threats.

2. Planners can consider a potential restoration site that has declining trends and an imperiled status to be more significant than one that is recovering. Planners should also consider the "recoverability" (the ability of human intervention to restore the natural productivity or condition of the ecosystem) of a degraded resource in examining a resource's status and trends.

(d) Connectivity is a measure of the potential for movement and dispersal of species throughout an area or ecosystem. It should be considered in the context of an entire landscape or watershed. The variation and quality of links between habitats in a landscape or watershed determine the level of connectivity.

1. Landscape spatial patterns that affect connectivity levels include the existence and suitability of habitat corridors, the degree and pattern of habitat fragmentation, and the presence of natural and man-made barriers. Often, rivers, waterways, and riparian forests serve as highly functional habitat corridors, and aquatic ecosystems inherently serve a connective function to other waterways and terrestrial landscapes.

2. Habitats may be recognized as technically significant if they improve connectivity by creating or re-establishing habitat corridors; by eliminating or addressing the pattern of fragmentation; or by removing barriers (for example, dams and other water blockages) that disrupt otherwise contiguous habitats.

(e) Limiting habitat is habitat that is essential for the conservation, survival, or recovery of one or more species. Limiting habitat may be both institutionally and technically significant. Under the Endangered Species Act, the Secretary of the Interior and the Secretary of Commerce have designated critical habitat for a portion, but not all, of the species listed as threatened or endangered. In that context, critical habitat is an example of limiting habitat with both institutional and technical significance. Since the term “critical habitat” has specific legal and regulatory ramifications, it should only be used in relation to federally listed species. The protection or restoration of limiting habitat for non-designated or non-federally listed species may be technically significant.

(f) Biodiversity is a measure of the variety of distinct species and the genetic variability within them. It can be measured at the individual level (genetic variation), population level (species variation), and the community level (variation of biological communities and interaction of ecosystem functions). In measuring diversity, biologists attempt to describe species richness (the number of species found in a community) as well as the distribution of individuals among species (how evenly the total number of individuals is divided among species). In general, diversity is greater if individuals are more evenly distributed. USACE planners may recognize as technically significant those restoration alternatives that serve to improve biodiversity within a specified area.

c. Documenting resource significance. In summary, the case can be made that environmental resources are significant based on technical recognition when, within a specified geographic range, those resources are either scarce; are representative of their respective ecosystems; will improve connectivity or reduce fragmentation of habitat; represent limiting habitat for important species; will improve or increase biodiversity; or trends indicate that the health of the resource is imperiled and declining, but can be recovered through human intervention.

4–8. Completeness, effectiveness, efficiency, and acceptability

Completeness, effectiveness, efficiency, and acceptability are the four evaluation criteria specified in the P&G in the screening of alternative plans. Alternatives considered in any planning study, not just ecosystem restoration studies, should meet minimum subjective standards of these criteria to qualify for further consideration and comparison with other plans.

a. Completeness. A plan must provide and account for all necessary investments or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private plans if these plans are crucial to the outcome of the restoration objective. Real property interests, OMRR&R, monitoring, and sponsorship factors must be considered. To address uncertainty concerning the functioning of certain restoration features, a monitoring and adaptive management plan must be included in the plan. A plan does not need to fully satisfy every planning objective or include all parts of a study area to be complete.

b. Effectiveness. An ecosystem restoration plan must make a significant contribution towards addressing the specified restoration problems or opportunities, for example, restoring important ecosystem structure or function to some meaningful degree. However, a plan does not need to fully satisfy every planning objective to still be considered effective.

c. Efficiency. An ecosystem restoration plan must represent a cost-effective means of addressing the restoration problem or opportunity. It must be determined that the plan's restoration outputs cannot be produced more cost effectively by another alternative plan or another agency or institution.

d. Acceptability. Acceptability is the extent to which alternative ecosystem restoration plans are acceptable in terms of applicable laws, regulations, and public policies. Support of the plan from state and federal resource agencies, local governments, the non-federal cost-sharing partner, and the public should be considered when recommending a plan; however, acceptability of the plan to these entities should not be the sole reason to constrain the identification of a NER plan, even if a plan other than the NER plan will ultimately be recommended.

4–9. Planning step five: plan comparison

Alternative plans that qualify for further consideration will be compared against each other to identify the recommended plan. A comparison of the effects of various plans must be made and tradeoffs among the differences must be observed and documented to support the final recommendation. The effects include a measure of how well the plans perform with respect to planning objectives and in consideration of the four P&G accounts: National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED). Effects required by law or policy and those important to the stakeholders and public must be considered. Previously, in the evaluation process, the effects of each plan were considered individually and compared to the without-project condition. In this step, plans are compared against each other, with emphasis on the important effects or those that influence the decision-making process. The comparison step concludes with a ranking of plans.

4–10. Risk and uncertainty considerations

When the costs and outputs of alternative restoration plans are uncertain and/or there are substantive risks that outcomes will not be achieved, the selection of a recommended alternative becomes more complex. It is essential to document the assumptions made and uncertainties encountered during the planning analyses.

a. Levels of risk. Restoration of some ecosystems may have a relatively low risk, such as removal of drainage tiles to restore hydrology to a wetland area. Other activities may have higher associated risks (for example, restoration of coastal marsh in an area subject to hurricanes).

b. Combined considerations. When identifying the NER plan the associated risk and uncertainty of achieving the proposed level of outputs must be considered. For example, if two plans have similar outputs but one plan costs slightly more, according to cost effectiveness guidelines, the more expensive plan would be dropped from further consideration. However, it is possible that, due to uncertainties beyond the control or knowledge of the planning team, the slightly more expensive plan will produce greater ecological output than originally estimated, in effect qualifying it as a cost-effective plan. Without considering the uncertainty inherent in the estimate of outputs, that plan would have been excluded from further consideration.

4–11. Planning step six: selection of ecosystem restoration plan

When selecting a single alternative plan for recommendation from all those that have been considered, the criteria used to make this decision includes all the evaluation criteria discussed above. Identifying the recommended plan requires careful consideration of the plan that meets planning objectives without violating constraints, reasonably maximizes environmental benefits while passing tests of CE/ICA, and reasonably maximizes other benefits (NED, EQ, OSE, and RED). Significance of outputs, acceptability, completeness, efficiency, and effectiveness are also considered. Additional factors include partnerships and reasonableness of costs.

a. Partnership context. Restoration projects that were planned in cooperation with other federal resource agencies, and where those agencies also have a significant role in implementing the project using their authorities and funding, should receive higher priority than those that do not, assuming they also satisfy the other criteria. Similarly, restoration projects that make a significant contribution to regional or national interagency programs (for example, the North American Waterfowl Management Plan, Marine Fish Habitat Creation and Restoration Program, Chesapeake Bay Program, etc.) should also receive priority.

b. Reasonableness of costs. All costs associated with a plan should be considered. After tests of CE and ICA have been satisfied, the team should consider the significance of the specific habitat type being restored and whether the incremental AAEQ cost per AAHU represents an efficient contribution to the USACE aquatic ecosystem restoration mission, given other opportunities that might exist within and

outside of the study area. This will almost always be a subjective decision and ultimately must rely on experience, reason, and common sense.

c. Documenting plan justification. Rarely will the NER plan not be among the “Best Buy” plans identified in the CE/ICA. If the recommended plan is not the NER plan, its selection must be justified. The reasons for such a selection should be explained in the report along with the potential implications for cost sharing. Recommending a plan other than the NER plan requires an exception from the ASA(CW).

Chapter 5
Plan descriptions

5–1. Description of aquatic ecosystem restoration plans

Ecosystem restoration study decision documents should describe the plan's features.

a. Plan description. The description of the restoration plan should be detailed enough to inform the public and others of the plan's location, size, features, costs, construction methods, maintenance requirements, and monitoring plans.

b. Level of detail. The details in the decision document should be sufficient to initiate design and implementation activities in the future. This entails providing adequate feasibility analysis of engineering considerations, real property interests required, environmental compliance, and sponsor's contributions and requirements.

5–2. Description of aquatic ecosystem restoration benefits

Decision documents for ecosystem restoration studies should describe the plan's features and the plan's benefits in both quantitative and qualitative terms.

a. Significance emphasis. The benefits description should emphasize the national or regional significance of the beneficial ecological effects of the recommended plan based on institutional, public, and technical recognition, including contributions to recognized plans. The ecological significance of the plan's effects should be clearly described, including scarcity of restored habitat types, habitat connectivity, provision of life requisites for special status species, the degree to which natural hydrologic and geomorphic conditions would be restored, and the self-sustainability of the recommended plan. Concise statements about the aspects of significance are important for future budgeting to implement projects.

b. Quantified benefits description. Ecological model outputs, the number of acres or stream miles of habitat to be protected or restored, and a description of proposed changes in habitat types and quality should be included in the benefits description.

c. Justification statement. A clear benefit justification statement must be included in the decision document recommendations section. It must provide a complete and concise description of the nature, quantity, quality, and significance of the ecosystem outputs, and describe how the incremental AAEQ cost per AAHU was considered.

Chapter 6
Additional operations and other opportunities

6–1. Additional restoration opportunities

Opportunities to contribute to aquatic ecosystem restoration objectives exist in other areas of the Civil Works program. These opportunities may be addressed through management of existing projects.

a. Existing operating projects. Restoration needs and opportunities at existing USACE projects should be considered. Where restoration opportunities involve USACE lands, input from the operations manager and natural resources management staff should be sought. Coordination with real estate staff is necessary to determine if actions are compatible with existing real property interests or rights held by the government or third parties (for example, fee, easement, license, permit to other federal agencies, or lease to non-federal party). Restoration measures that use only operational and management changes without added cost may be undertaken under existing discretionary authority rather than using Section 1135 of WRDA 1986 (33 USC 2309a) authority.

b. Master plans and operational management plans. Aquatic ecosystem restoration needs and opportunities will be incorporated in master plans and operational management plans consistent with ER 1130-2-540 and included in budget requests. A restoration measure must be compatible with the project purposes. If there is a significant restoration opportunity that is not compatible with existing purposes, it may be appropriate to examine this potential through Section 216 authority (33 USC 549a).

6–2. Other opportunities

a. Challenge Partnerships Program. The Challenge Partnerships Program, authorized by Section 225 of WRDA 1992 (33 USC 2328), provides opportunities for non-federal public and private groups and individuals to contribute to and participate in the operation and/or management of recreation facilities and natural resources at USACE water resources projects. Guidance for the Challenge Partnerships Program is contained in ER 1130-2-500.

(1) Real estate cannot be accepted as a partner’s contribution under these agreements. Work selected will be within current authority and contained in the annual or five-year plan in the approved OMRR&R Plan and will generally be accomplished in one fiscal year.

(2) Challenge Partnerships Program agreements must be negotiated and executed with non-federal public and private entities before partnership activities may begin.

b. Environmental dredging. Section 312 of WRDA 1990, as amended, (33 USC 1272) authorizes USACE to participate in the removal of contaminated sediments outside of the boundaries of and adjacent to federal navigation projects as part of O&M, and for the purposes of ecosystem restoration, not related to O&M of navigation

channels. The authority is not to be used to remove or remediate contaminated sediments classified as hazardous, toxic, and radioactive wastes, such as those at sites designated by a state or the U.S. Environmental Protection Agency for response action under the Comprehensive Environmental Response Compensation and Liability Act (42 USC 9601 et seq) (CERCLA), or at sites which are included on the National Priority List under CERCLA. Direct assistance to the Environmental Protection Agency on environmental cleanup activities including cleanup dredging and related studies may, however, be provided on a reimbursable basis.

(1) USACE can participate in removal and remediation of contaminated sediments located outside and adjacent to federal navigation channels when such sediments contribute to contamination of material in the channel and when it can be demonstrated that the costs of removal and remediation are economically justified based on savings of future O&M costs. (Savings in future O&M costs are those associated with reduction in dredging and disposal costs through the reduction of contaminated input into the navigation channel. For example, reduction of contaminated sediment may allow continuation or resumption of open water disposal and elimination of the need for more costly confined disposal.)

(a) Opportunities for these projects will be identified through dredged material management planning activities. Guidance on development, review, approval, and implementation of Dredged Material Management Plans is contained in ER 1105-2-103 and EM 1110-2-5025.

(b) The non-federal sponsor is responsible for all costs related to the disposal of the contaminated sediments. Recommendations that USACE participate in the removal of these sediments must demonstrate that the recommended cleanup plan is the most cost effective alternative consistent with sound engineering practices and established environmental standards, and that it maximizes net O&M savings considering both federal and non-federal costs.

(2) USACE may participate in removing contaminated sediments from navigable waters of the United States for the purposes of ecosystem restoration if requested by an appropriate non-federal sponsor and if it is consistent with program and budget priorities in effect. A non-federal sponsor will pay 50 percent of the removal and remediation cost. All costs related to the disposal of contaminated sediment are a non-federal responsibility. Such projects may include removal and disposal of contaminated sediment, removal and remediation of contaminated sediment, or remediation of contaminated sediments in place.

(3) Removal and remediation of contaminated sediments may be one component of comprehensive plans for ecosystem restoration. Creative solutions and financial partnerships involving all levels of government should be sought in developing removal and remediation plans. Duplication of federal programs should be avoided and plans for sediment removal and remediation should recognize appropriate federal, state, Tribal, and local agency roles. Projects will be evaluated and justified consistent with the policy and guidance provided for specifically authorized ecosystem restoration projects,

however the cost sharing requirements differ. Total federal expenditures to carry out sediment removal and remediation under this authority may not exceed $20 million in any fiscal year. Projects may be considered for a new start study, with a budget request developed and submitted consistent with Annual Program Engineer Circular.

(4) Specific authority from Congress is not required; preparation of a feasibility report will meet the requirement to develop a joint plan (33 USC 1272(c)). The ASA(CW) must approve the feasibility report. Construction starts for contaminated sediment removal and remediation projects will go through the budget process.

Appendix A
References

Section I

Required Publications

Unless otherwise indicated, all USACE publications are available on the USACE website at https://publications.usace.army.mil. Public laws, CFR and USC references are available at https://www.govinfo.gov.

Chesapeake Bay Program website
(Available at www.https://wwww.chesapeakebay.net)

EM 1110-2-5025
Dredging and Dredged Material Management

EP 1105-2-58
Continuing Authorities Program

ER 405-1-12
Real Estate Handbook

ER 1105-2-102
Watershed Studies

ER 1105-2-103
Policies for Conducting Civil Works Planning Studies

ER 1110-2-1302
Civil Works Cost Engineering

ER 1130-2-500
Partners and Support

ER 1130-2-540
Environmental Stewardship Operations and Maintenance Policies

ER 1165-2-400
Recreation Planning, Development and Management Policies

ERDC/EBA TN-08-1
The Application of Conceptual Models to Ecosystem Restoration. (Available at: https://www.erdc.usace.army.mil/Library/)

ERDC/EL TR-13-04
Science-based Framework for Environmental Benefits Assessment. (Available at: https://www.erdc.usace.army.mil/Library/)

ERDC/EL SR-19-9
A Systems Approach to Ecosystem Adaptive Management: A USACE Technical Guide. (Available at: https://erdc-library.erdc.dren.mil/)

Executive Order 13158
Marine Protected Areas

Federal Aviation Administration Advisory Circular 150/5200-33
Hazardous Wildlife Attractants on or near Airports (Available at: https://www.faa.gov)

IWR Planning Suite
Available at https://www.iwr.usace.army.mil

IWR Report 94-PS-2
Cost Effectiveness Analysis for Environmental Planning: Nine EASY Steps. (Available at: https://www.iwr.usace.army.mil/)

IWR Report 95-R-1
Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analyses. (Available at: https://www.iwr.usace.army.mil/)

IWR Report 97-R-4
Resource Significance Protocol for Environmental Project Planning. (Available at: https://www.iwr.usace.army.mil/)

Memorandum, DA (ASA(CW)
Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) Nooksack River Delta Setback Levees – Policy Concurrence. 26 May 2016 (Available at https://planning.erdc.dren.mil/)

Memorandum, DA ASA(CW)
Updated U.S. Army Corps of Engineers Civil Works Tribal Consultation Policy, 5 December 2023 (Available at https://planning.erdc.dren.mil)

Memorandum, Office of Science and Technology Policy and the Chair of the Council on Environmental Quality
Indigenous Traditional Ecological Knowledge and Federal Decision Making. 15 November 2021 (Available at https://www.whitehouse.gov/wp-content/uploads/2021/11/111521-OSTP-CEQ-ITEK-Memo.pdf)

Memorandum, Office of Science and Technology Policy and the Council on Environmental Quality
Guidance for Federal Departments and Agencies on Indigenous Knowledge. 30 November 2022 (Available at https://planning.erdc.dren.mil)

Nationwide Rivers Inventory
(Available at https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm)

North American Waterfowl Management Plan
(Available at https://www.fws.gov/partner/north-american-waterfowl-management-plan)

PL 89-72
Federal Water Project Recreation Act of 1965

PL 89-304
Anadromous Fish Conservation Act of 1965

PL 91-646
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970

PL 92-522
Marine Mammal Protection Act of 1972

PL 96-501
Northwest Power Act of 1980

PL 99-662
Water Resources Development Act of 1986

PL 101-640
Water Resources Development Act of 1990

PL 101-646
Coastal Wetlands Planning, Protection and Restoration Act

PL 104-303
Water Resources Development Act of 1996

PL 106-153
Water Resources Development Act of 1999

PL 110-114
Water Resources Development Act of 2007

PL 113-121
Water Resources Reform and Development Act of 2014

PL 114-322
Water Resources Development Act of 2016

PL 115-270
Water Resources Development Act of 2018

PL 116-260
Water Resources Development Act of 2020

PL 117-263
Water Resources Development Act of 2022

U.S. Army Corps of Engineers
National Shoreline Management Study
(https://www.iwr.usace.army.mil/missions/coasts/national-shoreline-management/)

U.S. Army Corps of Engineers
Upper Mississippi River System Environmental Management Program (Available at https://www.mvr.usace.army.mil/)

U.S. Environmental Protection Agency
National Estuary Program website. (Available at https://www.epa.gov)

U.S. Fish and Wildlife Service
National Wetlands Priority Conservation Plan. June 1991. (Available at https://www.fws.gov/media/national-wetlands-priority-conservation-plan)

U.S. Fish and Wildlife Service
Office of Migratory Bird Management, species lists
(https://www.fws.gov/program/migratory-birds/species)

U.S. Water Resources Council
Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 10 March 1983 (Available at https://planning.erdc.dren.mil)

16 USC 59A
Coastal Wetlands Planning, Protection and Restoration Act

16 USC 661-666(e)
Fish and Wildlife Coordination Act

16 USC 1531 et seq.
Endangered Species Act of 1973, as amended

16 USC 3901
Emergency Wetland Resources Act of 1986

22 USC 2330
Aquatic ecosystem restoration

33 USC 549a
Review of navigation, flood control, and water supply projects

33 USC 1251 et seq.
Clean Water Act

33 USC 1272
Environmental Dredging

33 USC 1330
National Estuary Program

33 USC 2213
Flood control and other purposes

33 USC 2215
Feasibility studies; planning, engineering, and design

33 USC 2267a
Study of water resources needs of river basins and regions

33 USC 2289a
Consideration of measures

33 USC 2309a
Project modifications for improvement of environment

33 USC 2316
Environmental protection mission

33 USC 2326
Regional sediment management

33 USC 2326g
Beneficial use of dredged material; dredged material management plans

33 USC 2328
Challenge Cost-Sharing Program for the Management of Recreation Facilities

33 USC 2330
Aquatic ecosystem restoration

33 USC 2330a
Monitoring ecosystem restoration

33 USC 2332
Shoreline and riverine protection and restoration

33 USC 2341a
Prioritization

33 USC 2902
Definitions

33 USC 2903
Estuary habitat restoration program

42 USC 1962d-5e
Wetland areas

42 USC 1962d–16
Comprehensive plans for development, utilization, and conservation of water and related resources

42 USC 9601 et seq.
Comprehensive Environmental Response, Compensation, and Liability Act

54 USC 300101 et seq.
National Historic Preservation Act

Glossary of Terms

Term	Definition
AAEQ	Average annual equivalent
AAHU	Average annual habitat units
ARIMS	Army Records Information Management System
ASA(CW)	Assistant Secretary of the Army for Civil Works
CE/ICA	Cost effectiveness and incremental cost analysis
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
EQ	Environmental Quality
ERDC	Engineer Research and Development Center
IWR	Institute for Water Resources
LERRD	Lands, easements, rights-of-way, relocations, and disposal areas
NED	National Economic Development
NER	National Ecosystem Restoration
O&M	Operation and Maintenance
OMRR&R	Operation, Maintenance, Repair, Replacement, and Rehabilitation
P&G	Economic and Environmental Principles and Guidelines for Water and Land Related Resources Implementation Studies (1983)
PL	Public Law
RRS-A	Records Retention Schedule – Army
RED	Regional Economic Development
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act

Adaptive management
A formal, science-based approach to risk management that permits implementation of actions despite uncertainties. Knowledge gained from monitoring and evaluating results is used to adjust and direct future decisions.

Aquatic ecosystem restoration
The dynamic and interrelating complex of biotic communities and their associated nonliving environment, considered as an integrated unit. Implied within this definition are the concepts of structure and function. Ecosystem restoration is scalable and may encompass multiple states, more localized watersheds, or a smaller complex of aquatic habitats.

Assistant Secretary of the Army for Civil Works
The Assistant Secretary of the Army for Civil Works establishes policy direction and provides supervision of the Department of the Army functions relating to all aspects of the Civil Works program of the United States Army Corps of Engineers.

Average-annual equivalent costs
Costs derived from first calculating all costs in terms of present worth using the appropriate discount rate and then annualizing using the same discount rate.

Average annual habitat units
A unit measuring the output of a restoration plan. Units are obtained by computing the difference between the baseline no action plan compared to the habitat improvement results of a restoration plan alternative. The outputs can be annualized for comparing outputs against costs and to compare different restoration plans.

Combined plans
For plans formulated to produce both economic and restoration benefits, the plan with the greatest economic and restoration benefits relative to the costs is to be selected, consistent with protecting the Nation's environment, unless the ASA(CW) grants an exception. These plans will be designated as Combined Plans.

Comprehensive Environmental Response Compensation and Liability Act
The Comprehensive Environmental Response Compensation and Liability Act passed by Congress in 1980.

Cost effectiveness and incremental cost analysis
A method of analysis and comparison to discover and display variation in costs, and to identify and describe the least cost plan.

Critical habitat
Critical habitat is the specific areas within the geographic area, occupied by the species at the time it was listed, that contain the physical or biological features that are essential to the conservation of endangered and threatened species and that may need special management or protection. Critical habitat may also include areas that were not occupied by the species at the time of listing but are essential to its conservation.

Ecosystem restoration
Ecosystem restoration improves degraded ecosystem structure and function to a less degraded, more natural condition. Restored ecosystems should mimic, as closely as possible, conditions that would occur in the area in the absence of human changes to the landscape and hydrology. The goal is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system.

Ecosystem structure and function
Structure refers to the composition of the ecosystem in terms of its various parts and the physical and biological organization defining how those parts are organized. Ecosystem function is the process that takes place in an ecosystem through the interactions of the plants, animals, and other organisms in the ecosystem with each other or their environment. Ecosystem structure and function provide various ecosystem goods and services of value to humans such as fish for recreational or commercial use, clean water to swim in or drink, and various esthetic qualities.

Engineer Research and Development Center
The Center conducts research and development in support of the Soldier, military installations, and the Corps of Engineers' civil works mission, as well as for other federal agencies, state, and municipal authorities, and with U.S. industries.

Enhancement
The manipulation of the physical, chemical, or biological characteristics of a habitat to change a specific function or seral stage of the habitat.

Environmental Quality
The Environmental Quality account displays effects on significant natural and cultural resources.

Environmental restoration
Care should be taken in the use of this term, which is often inappropriately used interchangeably with “ecosystem restoration.” In the context of USACE programs and missions, “environmental restoration” is more commonly associated with "cleanup" measures undertaken to achieve compliance with state and/or federal laws or regulations to clean up hazardous, toxic, and radioactive wastes. It generally refers to actions such as Comprehensive Environmental Response, Compensation and Liability Act remedial actions, Resource Conservation and Recovery Act corrective actions, and cleanups related to underground storage tanks.

Institute for Water Resources
The Institute for Water Resources was established to provide forward-looking analysis, cutting-edge methodologies, and innovative tools to aid USACE’s Civil Works program.

Lands, easements, rights-of-way, relocations, and disposal areas
Lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas needed to construct a water resources development project.

Locally preferred plan
A Locally Preferred Plan is a plan that is supported by the non-Federal partner that is different from the NED, NER, or total net benefits plan.

Mitigation
Mitigation consists of those measures taken to avoid, minimize, rectify, reduce, or compensate for adverse environmental impacts. Compensatory mitigation measures are designed to replace ecological resources unavoidably affected by a USACE project or activity. EP 1105-2-60, Environmental Evaluation and Compliance discusses mitigation in more detail, along with other environmental compliance requirements.

National Economic Development
The National Economic Development account displays changes in the economic value of the national output of goods and services.

National Ecosystem Restoration
National Ecosystem Restoration analysis documents increases or decreases in the net quantity and/or quality of desired ecosystem resources.

Net ecosystem restoration benefits
The recommended plan ordinarily is the alternative having the maximum excess of monetary and non-monetary beneficial effects over monetary and non-monetary costs. This plan occurs where the incremental beneficial effects just equal the incremental costs, or alternatively stated, where the extra ecosystem value is just worth the extra costs. This plan should be called the National Ecosystem Restoration plan. In making these value and cost comparisons it is assumed that each alternative plan is the minimum cost way of achieving that level of output (that an appropriate least cost or cost effectiveness algorithm was used in their development). Deviations from the NER plan requires justification and the granting of an exception from the Assistant Secretary of the Army (Civil Works).

Nonstructural and Nonmechanical Elements
Nonstructural and nonmechanical elements are management actions that are undertaken to achieve an outcome or a natural feature that is created to contribute to ecosystem restoration objectives. These can include planting native vegetation, removing or controlling invasive species; establishing oyster reefs or other living shorelines; placing dredged material to create marsh; dredging to reconnect channels and floodplains; or placement of large woody debris to create habitat and manage flow. For ecosystem restoration projects, or projects with an ecosystem restoration component, the term is significant because of law and guidance specifying different non-federal sponsor operations and maintenance responsibilities for nonstructural/nonmechanical elements.

Operations and maintenance (O&M) and Operations, maintenance, repair, replacement, and rehabilitation (OMRR&R)
For USACE projects, activities that are conducted by a non-federal partner or USACE to support the function of a constructed water resources development project.

Other Social Effects
The Other Social Effects account registers plan effects from perspectives that are relevant to the planning process but are not reflected in the National Economic Development, National Ecosystem Restoration, or Environmental Quality accounts.

Period of analysis
Each alternative plan will have the same period of analysis. The period of will be one of the following: (1) the period of time over which any alternative plan would have significant beneficial or adverse effects; or (2) a period not to exceed 50 years except for major multiple purpose reservoir projects; or (3) a period not to exceed 100 years for major multiple purpose reservoir projects; or (4) a period of up to 100 years for projects that have prior approval and/or study specific guidance. Forecasts should extend from the base year to the end of the period of analysis. The base year is the year when a proposed project alternative is expected to be fully operational. The same period of analysis and base year will be applied to the FWOP condition, and each alternative plan evaluated. In cases where alternatives have differing base years, a common base year will be established against which all alternatives are compared. The common base year can be selected from any of the alternatives being compared, however, a rationale for why a particular base year was used for the alternative comparison must be provided. Impacts (benefits and costs) during implementation/ construction that accrue for any alternative prior to the common base year must still be accounted for by compounding or discounting to that base year and documented in the analysis.

Principles and Guidelines
The 1983 Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies are also known as the “P&G.” The P&G have provided direction to Federal agencies when evaluating and selecting major water projects, including projects related to navigation, storm resilience, wetland restoration, and flood prevention.

Protection
A type of restoration that prevents the loss of habitat.

Regional Economic Development
The Regional Economic Development account displays the regional and localized economic impacts that result from each alternative plan.

Restoration feature
A feature is a part of an alternative plan that requires construction or assembly on-site in the project area.

Restoration measure
A feature or activity, that can be implemented at a specific geographic site to address one or more restoration planning objectives.

Significance of outputs
The recognition of ecosystem restoration project outputs in terms of institutional, public, and technical importance. Collectively this assessment of outputs helps decision makers in the “is it worth it” aspect of recommending a plan.

Systems approach
Ecosystem restoration planning and management should be watershed in scale using systems analysis methods and tools to understand, assess, and model the interconnected nature of hydrologic systems (for example, watersheds) and the economic and ecologic systems they support, and to identify and evaluate management alternatives from both time (lifecycle) and function (multi-purpose) perspectives.

Terrestrial buffer
Generally, refers to a buffer area adjacent to an aquatic site. This may include portions of a floodplain that infrequently flood, other riparian areas, or uplands adjacent to aquatic sites. Buffers are important as wildlife corridors, habitat for terrestrial and avian species, and in providing vegetation that reduces sedimentation and that may provide shade or other functions that support a healthy system.

U.S. Code
The consolidation and codification, by subject matter, of the general and permanent laws of the United States.

Water Resources Development Act
The primary authorizing legislation for the U.S. Army Corps of Engineers. This comprehensive legislative package is typically passed every two years and may include both Congressional policy direction and authorization for USACE water resources activities including studies, projects, programs, and research activities.

Water Resources Reform and Development Act
The Water Resources Reform and Development Act passed by Congress in 2014.