



Statement of

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The viability of incorporating Natural
Infrastructure in Bureau of Reclamation Water
Management Systems”**

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Chairman Wyden, ranking member Hyde-Smith, and members of the subcommittee, my name is Charles Stern. I am a Specialist in Natural Resources Policy at the Congressional Research Service (CRS). Thank you for inviting CRS to testify. This CRS statement focuses on the authorities of the U.S. Bureau of Reclamation (Reclamation) and provides relevant general context on natural and nature-based infrastructure.¹

In serving Congress on a nonpartisan and objective basis, CRS takes no position on legislation and makes no recommendations. CRS remains available to assist the subcommittee in its development and consideration of water resource and other legislation.

I will start by providing context for federal efforts on natural infrastructure. I will then discuss the Bureau of Reclamation's authorities and potential opportunities for the incorporation of natural infrastructure in its activities, including questions for policy makers.

Background on Natural Infrastructure

Historically, researchers, practitioners, and decisionmakers have used a variety of terms to describe natural features and combinations of traditional hard or gray features with natural components that are used to restore or mimic natural processes. These features may be implemented to achieve certain objectives for humans and wildlife. Some of the most common terms used to describe these features include natural infrastructure, nature-based infrastructure, green infrastructure, natural features, and nature-based features, among others.² I will use the term “natural infrastructure” in this testimony, but others stakeholders may use different terms.

Natural infrastructure sits on a continuum from natural areas, such as forested lands, to combinations of natural “green” components and engineered or “gray” (e.g., rock, steel, and concrete) components. The benefits of using natural infrastructure include a range of functions, or ecosystem services, such as evaporation, infiltration into the ground, water storage (i.e., within soils, groundwater, and wetlands), erosion and sediment regulation, flood and drought protection, natural resource provisioning (e.g., fisheries, agricultural products, and hydropower), carbon sequestration, and aesthetic and recreation value, among others.³ Examples of various types of natural infrastructure are depicted below in **Figure 1**.

¹ Eva Lipiec, Analyst in Natural Resources Policy, assisted in preparing this written testimony, particularly the portions that focus on background information related to natural infrastructure.

² The specific features included within a term's definition vary depending on the environmental context, project goals, and supporting entity in question. Other terms include nature-based solutions and hybrid infrastructure, among others. For more information about these terms and others, see United Nations World Water Assessment Programme/UN-Water, *The United Nations World Water Development Report 2018: Nature-Based Solutions for Water*, 2018, p. 23. Hereinafter referred to as *UN NBS For Water*, 2018.

³ *UN NBS For Water*, 2018, p. 42.

Figure 1. Illustration of natural infrastructure for water management

Natural Infrastructure for Water Management

Investing in nature for multiple objectives



Source: IUCN Water Programme, “Natural Infrastructure for Water Management – Investing in nature for multiple objectives,” at <https://www.iucn.org/theme/water/resources/infographics>.

Selected Federal Agency Definitions and Applications of Natural Infrastructure

Some federal agencies have supported natural infrastructure under existing statutory authorities. For example, the National Oceanic and Atmospheric Administration (NOAA) has supported the use of natural infrastructure features to fulfill the agency's mandate to research, restore, and conserve natural resources.⁴ However, Congress has not defined natural infrastructure in statutes related to NOAA activities.⁵ Where Congress has been involved, interest in natural infrastructure has evolved over time. While interest may have been initially in the environmental and social benefits of natural infrastructure, especially as part of restoration efforts, interest in the economic benefits of these features has grown.⁶

In recent years, Congress has begun to explicitly define natural infrastructure, as well as nature-based and green infrastructure, in statute for some federal agencies. Congress has directed selected agencies to consider and use natural infrastructure in specific ways. For example, as part of the Water Infrastructure Improvements for the Nation Act of 2016 (P.L. 114-322), Congress defined a natural feature as a feature “created through the action of physical, geological, biological, and chemical processes over time,”⁷ and a nature-based feature as “a feature that is created by human design, engineering, and construction to provide risk reduction by acting in concert with natural processes.”⁸ Congress enacted these definitions in the context of the water resource authorities of the U.S. Army Corps of Engineers (USACE). USACE refers to these features collectively as natural and nature-based features (NNBFs). In the same legislation, Congress directed USACE to consider NNBFs in its planning of flood risk management, hurricane and storm damage reduction, and ecosystem restoration projects.⁹ As discussed later in this testimony, Congress also provided similar definitions in amendments to the Reclamation WaterSMART program authorized in the Western Water and Indian Affairs title of P.L. 116-260.

Congress has also defined green infrastructure, a similar but not always synonymous term, in the context of the U.S. Environmental Protection Agency's (EPA's) authorities under the Clean Water Act (CWA). Under the 2019 Water Infrastructure Improvement Act (P.L. 115-436), green infrastructure is defined as “the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters.”¹⁰ The act also directed EPA to promote the use of green infrastructure in CWA permitting and enforcement, planning efforts, research, technical assistance, and funding guidance.

Other agencies may have their own working definitions that were developed administratively. For example, NOAA defines natural infrastructure as “healthy ecosystems, including forests, wetlands, floodplains, dune systems, and reefs, which provide multiple benefits to communities, including storm

⁴ See National Oceanic and Atmospheric Administration, *NOAA National Habitat Policy*, NAO 216-17, June 30, 2015, Section 4, at <https://www.noaa.gov/organization/administration/nao-216-17-noaa-national-habitat-policy#References>.

⁵ For more information, see CRS Report R46145, *Nature-Based Infrastructure: NOAA's Role*, by Eva Lipiec.

⁶ For example, the National Oceanic and Atmospheric Administration (NOAA) highlights several studies regarding the economic benefits of certain coastal natural infrastructure at NOAA Office of Coastal Management, “Fast Facts: Natural Infrastructure,” at <https://coast.noaa.gov/states/fast-facts/natural-infrastructure.html>.

⁷ P.L. 114-322, Section 1184; 33 U.S.C. §2289a(a)(1).

⁸ P.L. 114-322, Section 1184; 33 U.S.C. §2289a(a)(2).

⁹ For more information, see CRS Report R46328, *Flood Risk Reduction from Natural and Nature-Based Features: Army Corps of Engineers Authorities*, by Nicole T. Carter and Eva Lipiec.

¹⁰ P.L. 115-436, Section 5; 33 U.S.C. §1362(27).

protection through wave attenuation or flood storage capacity and enhanced water services and security.”¹¹ NOAA describes nature-based infrastructure as “engineered systems where natural features are combined with more hard or structural engineering approaches to create a hybrid system.”¹²

Natural Infrastructure in the Context of Water Availability

In the water availability context, natural infrastructure primarily addresses water supply, rather than demand, through managing water storage, infiltration, and conveyance.¹³ These efforts may include conserving and restoring forests, reconnecting rivers to floodplains, creating spaces for bioretention and infiltration,¹⁴ and combining one or more of these features with managed aquifer recharge.¹⁵ Some of the benefits of these actions may include reducing flash flooding, increasing groundwater storage, and improving late season runoff, among other things. There are a variety of options to support the implementation of these features, including direct financial support, technical assistance, grants, loans, tax incentives, and payments for ecosystem services, among other things.¹⁶

Multiple federal agencies provide support for natural infrastructure that improves water availability; this support is typically provided to meet various objectives and mission areas. For example, the Department of the Interior (DOI; including Reclamation), EPA, and the U.S. Department of Agriculture (USDA) all have broad authorities to provide financial assistance for aquifer recharge. At the same time, USACE, NOAA, USDA, and multiple bureaus within DOI, among others, all have authorities that support the use of natural infrastructure to restore portions of ecosystems at various scales.¹⁷

¹¹ NOAA, “NOAA Administrative Order 216-117, Section 3. Definitions” at <https://www.noaa.gov/organization/administration/nao-216-17-noaa-national-habitat-policy#section3>.

¹² NOAA, “NOAA Administrative Order 216-117, Section 3. Definitions” at <https://www.noaa.gov/organization/administration/nao-216-17-noaa-national-habitat-policy#section3>.

¹³ *UN NBS For Water*, 2018, p. 38.

¹⁴ For example, bioretention structures are “typically pits filled backfilled with soil, mulch, and vegetation used to retain runoff for infiltration through the filter bed components, with reliance on biological and biochemical reactions within the soil matrix and around the root zones of the plants” (*UN NBS For Water*, 2018, p. 56).

¹⁵ *UN NBS For Water*, 2018, pp. 32 and 76. Managed aquifer recharge generally refers to purposeful recharge of water to aquifers for subsequent recovery or for environmental benefit. It may involve purposefully injecting water into an aquifer through an aquifer storage and recovery well, or allowing water to recharge from a space dedicated to bioretention or infiltration (e.g., a spreading basin). For more information on groundwater supply, see CRS Report R45259, *The Federal Role in Groundwater Supply*, by Peter Folger et al.

¹⁶ For examples of financial support mechanisms, see Browder, et al., *Integrating Green and Gray: Creating Next Generation Infrastructure*, 2019, World Bank and World Resources Institute, at <https://openknowledge.worldbank.org/handle/10986/31430>, and Colgan, C.S., M.W. Beck, and S. Narayan, *Financing Natural Infrastructure for Coastal Flood Damage Reduction*, 2017, at https://www.middlebury.edu/institute/sites/www.middlebury.edu.institute/files/2018-07/6.13.17.LLYODS.Financing%20Natural%20Infrastructure%201JUN_.2017_Lo%20Res.pdf.

¹⁷ For example, §306 of the Water Resources Development Act of 1990 (P.L. 101-640; 33 U.S.C. §2316) directed the Secretary of the Army to include environmental protection (now commonly referred to as ecosystem restoration or environmental restoration) as one of the primary missions of USACE in planning, designing, constructing, operating, and maintaining water resources projects. Since that authority, Congress has authorized and funded USACE to study and construct projects under project specific authorities and under programmatic authorities, such as Section 206, 1135, and Section 204 Continuing Authorities Programs.

Incorporating Natural Infrastructure into Bureau of Reclamation Authorities

Background¹⁸

Congress created the Reclamation Service (the precursor to the Bureau of Reclamation) in 1902. Since that time, Reclamation has constructed more than 180 congressionally authorized projects throughout the 17 arid and semiarid Reclamation states.¹⁹ Most of these “reclamation projects” consist of some combination of dams, surface storage reservoirs, and water conveyance infrastructure. Many of these projects continue to be operated by Reclamation to provide water supplies for agricultural irrigation and municipal and industrial uses, to generate hydropower, and to benefit the environment, among other purposes.

Over the last 50 years, Reclamation has shifted its focus, first from project construction to operations and maintenance of existing projects. Then, in the early 1990’s Congress began directing Reclamation to expand its support for nonfederally led projects, including those for water reuse and recycling, water and energy efficiency modernization efforts, and desalination. Congress added further to these efforts in 2009 under P.L. 111-11. As a result, Reclamation’s current activities can be broadly characterized as a split between (1) operation and oversight of “traditional” reclamation projects (i.e., federally-owned water supply projects that provide low-cost water to agricultural and municipal contractors) and (2) financial and technical support for nonfederal efforts to conserve or create water supplies in the West, including grants for water efficiency and authorized projects for water recycling, desalination, and rural water supply, among other efforts.²⁰ While the first category continues to account for the majority of congressionally appropriated funding for Reclamation, the latter category has grown in recent years.²¹

Current Authorities: Support for Groundwater Storage and Restoration Projects

Based on Reclamation’s mission and activities, the primary opportunities for Reclamation to incorporate natural infrastructure solutions into its activities may involve efforts to improve natural water storage, in particular storage available in groundwater aquifers. These efforts can involve managed aquifer recharge as well as restoration of riverine ecosystems and floodplains to a more natural state that allow for surface waters to replenish groundwater supplies.

Groundwater Storage

Historically, Reclamation has not managed or administered significant aquifer recharge programs or facilities, but has had experience with aquifer recharge activities in some locations. In the Lower Colorado River Basin, the bureau is authorized to enter into agreements to store Colorado River water off-stream (including in groundwater storage) for future use. Some projects, such as the Central Arizona

¹⁸ For more information on Reclamation, see CRS Report R46303, *Bureau of Reclamation: History, Authorities, and Issues for Congress*, by Charles V. Stern and Anna E. Normand.

¹⁹ 43 U.S.C. §391. The 17 states are Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Congress also added the territories to Reclamation’s authorized service area.

²⁰ For more information on Reclamation’s rural water projects, see CRS Report R46308, *Bureau of Reclamation Rural Water Projects*, by Anna E. Normand.

²¹ In FY2021 enacted appropriations, Reclamation’s WaterSMART and Rural Water Programs received appropriations of \$276 million of Reclamation’s \$1.61 billion appropriation (approximately 17 percent). For more information, see CRS In Focus IF11465, *Bureau of Reclamation: FY2021 Appropriations*, by Charles V. Stern.

Project (which conveys Colorado River waters), convey water that is used in extensive groundwater banking operations that store excess or recycled supplies. Part of another Reclamation project—the Friant Division of Reclamation’s Central Valley Project in California—was designed and is operated as a conjunctive use project, with groundwater and surface water facilities managed jointly.

Congress has also authorized financial support for several specific groundwater storage projects as part of a broader legal settlement and restoration effort. As part of the San Joaquin River Restoration Settlement Act authorized in P.L. 111-11, Congress approved financial assistance to local agencies within the Central Valley Project for the purposes of designing and constructing groundwater recharge/banking facilities that offset water supply impacts to water contractors. The act provided a total of \$50 million of cost-shared funding to assist agencies in constructing these groundwater recharge facilities. To date, two of the four facilities have been completed.²²

Congress has also approved broader programmatic authorities that Reclamation may use to support groundwater storage projects, among other things. These include:

- Title IX, Subtitle F (Secure Water), Section 9504 of the Omnibus Public Land Management Act of 2009 (P.L. 111-11) authorizes Reclamation to provide financial assistance (i.e., grants) through the WaterSMART program for groundwater projects.²³
- Reclamation's Title XVI program (Title XVI of the Reclamation Projects Authorization and Adjustment Act of 1992, P.L. 102-575 , as amended) provides Reclamation with the authority to implement water recycling and reuse projects, which may include projects that recycle and reuse impaired groundwater.
- Title III, Section 4007(c) of the Water Infrastructure Improvements for the Nation Act (WIIN Act; P.L. 114-322) authorizes Reclamation to participate in state-led water storage projects, which are defined to include groundwater storage facilities, among other facility types.

Reclamation and local water users have utilized some of these programmatic authorities for natural infrastructure more than others. For example, from 2012-2019, the WaterSMART Water and Energy Efficiency Grant program authorized in P.L. 111-11 funded at least 19 nonfederal projects with groundwater storage or recharge components. Eleven of these projects were in California, with other projects in Idaho, Colorado, Washington, Oregon, and Arizona. Similarly, Reclamation recently reported that since 2017, it has funded 15 Title XVI projects with major groundwater storage or aquifer replenishment aims.²⁴

Among WIIN Act Section 4007 storage projects, as of early 2021 Reclamation had allocated funding for 12 water storage projects costing \$306 million, but only one of these projects (the Sacramento Regional Water Bank) is for groundwater storage. The project has received less than \$1 million to date.²⁵

²² For more information, see San Joaquin River Settlement Program, “Groundwater Banking Projects,” at <https://www.restoresjr.net/projects/water-management-goal/groundwater-banking-projects/>.

²³ For more information on the WaterSMART program, see U.S. Bureau of Reclamation, “WaterSMART (Sustain and Manage America's Resources for Tomorrow),” at <https://www.usbr.gov/watersmart/>.

²⁴ CRS Correspondence with Bureau of Reclamation, March 19, 2021. For example, Reclamation approved and provided funding for the Aquifer Storage and Recovery Using Reclaimed Water Project in El Paso, Texas. This project will treat impaired surface water for groundwater infiltration at the Hueco Bolson Aquifer. More project descriptions are available at <https://www.usbr.gov/watersmart/title/index.html>.

²⁵ For more information, see Regional Water Authority, “Sacramento Regional Water Bank,” at <https://rwah2o.org/sacramento-regional-water-bank/>.

Ecosystem Restoration

In regard to ecosystem restoration, in the past, Reclamation has typically aligned its ecosystem restoration and fish and wildlife “enhancement” activities with project purposes, as well as with other relevant laws such as the Endangered Species Act.²⁶ Congress has included or added fish and wildlife benefits to the authorized purposes for some Reclamation projects.²⁷ In other cases, Congress has authorized standalone Reclamation restoration programs and activities,²⁸ or has authorized Reclamation to conduct efforts to respond to endangered species concerns.²⁹ Projects undertaken with these authorities often support activities, such as river and stream-bank protection and enhancement, which may benefit natural watershed services and functions.

Recent Changes

The 116th Congress considered and enacted several changes related to natural infrastructure in the Western Water and Indian Affairs title of P.L. 116-260 (Title XI of Division FF) in December 2020.³⁰ In Section 1105 of the title, Congress directed that reclamation project infrastructure could be used to convey non-project water for the purposes of aquifer recharge (subject to the applicable rates and requirements), and that reclamation project water contractors could use and/or contract for recharge activities involving project water. While recharge activities were reportedly occurring to some extent in prior years, this was the first formal, reclamation-wide guidance from Congress on this subject.

In Section 1106 of the title, Congress added specific definitions for “natural feature” and “nature-based feature” in the context of WaterSMART grants and research agreements as authorized in P.L. 111-11,³¹ and formally recognized these as eligible project types for grants. The same section also provided for additional federal cost-share coverage (i.e., raising the cost-share ceiling from 50 percent to 75 percent) for certain projects developed by watershed groups or multiple users; this could apply to projects with natural and nature-based features that meet this criteria.³²

Section 1109 of the title authorized \$15 million for Reclamation to provide assistance to states, state-based entities, tribes, and non-profits, among others, for the design, study, and construction of aquatic ecosystem restoration and protection projects for the benefit of fish and wildlife. These projects, which have yet to be funded, may in some cases provide Reclamation the opportunity to support additional ecosystem services.

²⁶ 16 U.S.C. §§1531-1544. For more information on the Endangered Species Act, see CRS Report R46677, *The Endangered Species Act: Overview and Implementation*, by Pervaze A. Sheikh, Erin H. Ward, and R. Eliot Crafton.

²⁷ For instance, in P.L. 102-575 Congress added fish and wildlife as an authorized purpose of Reclamation’s largest project, the California Central Valley Project.

²⁸ For example, the Glen Canyon Dam Adaptive Management Program was established in 1997 in response to a directive from Congress under the Grand Canyon Protection Act of 1992 (P.L. 102-575) to operate Glen Canyon Dam “in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established.”

²⁹ DOI and its implementing partners established the Upper Colorado Endangered Fish Recovery Program in 1988 to assist in the recovery of four species of endangered fish in the Upper Colorado River Basin. Congress formally authorized Reclamation to carry out this program in 2000 under P.L. 106-392.

³⁰ Title XI of Division FF of P.L. 116-260.

³¹ Similar to the USACE definitions in Water Infrastructure Improvements for the Nation Act of 2016, “natural feature” was defined as “a feature that is created through the action of physical, geological, biological, and chemical processes over time,” while “nature-based feature” was defined as “a feature that is created by human design, engineering, and construction to provide a means to reduce water supply and demand imbalances or drought or flood risk by acting in concert with natural processes.”

³² Funding for WaterSMART grants from FY2017-FY2021 averaged \$40 million.

Potential Issues for the 117th Congress

In the 117th Congress, some stakeholders may propose further prioritizing natural infrastructure in Reclamation activities; some of this attention may be enhanced by regional drought concerns and flood events. Other stakeholders may raise concerns that efforts to have increased Reclamation participation in natural infrastructure activities may hamper or compete with the agency's efforts to operate and maintain existing, aging infrastructure.

Congress may debate the extent to which “natural water storage projects” might merit a set-aside or other priority in certain Reclamation programs, such as for WaterSMART grants or in any proposed extensions of the WIIN Act's Section 4007 storage authority (which expires in December 2021). Congress could also consider agency-specific guidance for how Reclamation should incorporate natural infrastructure into other projects and programs, as it has done for USACE. Some support congressional approval of new Reclamation financing authorities that could leverage funding for natural infrastructure projects, among other things. Most prominently, this includes the “Reclamation Water Infrastructure Financing and Innovation Act (RIFIA),” a proposed loan authority which would operate similarly to existing water financing authorities of EPA and USACE.³³

When considering whether and how to make available additional authorities and funding to Reclamation for natural water infrastructure, Congress may wish to consider several questions:

- What is known and what research is underway to understand the efficiency and efficacy of natural infrastructure for enhancing water availability?
- How do natural infrastructure options compare to other alternatives in terms of life-cycle costs, reliability, and environmental and social impacts?
- What are the primary impediments to incorporating more natural infrastructure into Reclamation's water management activities?
- What is the demand for the natural water storage projects, and how would increased federal funding support for these projects be likely to affect this demand?
- Which states stand to benefit the most from support for natural infrastructure by Reclamation? How accommodating are various state water rights systems to natural infrastructure?
- What is the preferred federal role in supporting natural infrastructure? Is Reclamation the agency best suited to support these projects? What other federal agencies (if any) support the type of nature-based projects that Reclamation is most likely to target?

This concludes my prepared remarks. Thank you for the opportunity to testify, and I look forward to answering any questions you may have. If additional research and analysis related to this issue would be helpful, my colleagues and I at CRS stand ready to assist the subcommittee.

³³ Congress authorized WIFIA to support a range of water infrastructure projects, including projects for aquifer recharge, development of alternative water supplies to reduce aquifer depletion, as well as environmental restoration. However, these authorities are nationwide in scope, whereas proposals for a Reclamation-centered program have largely been limited to western states. For more information on these authorities, see CRS Report R43315, *Water Infrastructure Financing: The Water Infrastructure Finance and Innovation Act (WIFIA) Program*, by Jonathan L. Ramseur, Mary Tiemann, and Elena H. Humphreys and CRS Insight IN11577, *U.S. Army Corps of Engineers Civil Works Infrastructure Financing Program (CWIFP): Status and Issues*, by Anna E. Normand and Elena H. Humphreys.

Appendix.

Statutory Definitions of Selected Natural Infrastructure-Related Terms

Citation	Term	Agency	Definition in Statute
Water Infrastructure Improvements for the Nation Act, P.L. 114-322, §1184; 33 U.S.C. §2289a(a)(1)	Natural feature	USACE	“The term ‘natural feature’ means a feature that is created through the action of physical, geological, biological, and chemical processes over time.”
Water Infrastructure Improvements for the Nation Act of 2016, P.L. 114-322, §1184; 33 U.S.C. §2289a(a)(2)	Nature-based feature	USACE	“The term ‘nature-based feature’ means a feature that is created by human design, engineering, and construction to provide risk reduction by acting in concert with natural processes.”
Water Infrastructure Improvement Act, P.L. 115-436, §5; 33 U.S.C. §1362(27)	Green infrastructure	EPA	“The term ‘green infrastructure’ means the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters.”
Consolidated Appropriations Act, 2021, P.L. 116-260, Division FF, Title XI, §1106; not yet included in the U.S. Code	Natural feature	BOR	“The term ‘natural feature’ means a feature that is created through the action of physical, geological, biological, and chemical processes over time.”
Consolidated Appropriations Act, 2021, P.L. 116-260, Division FF, Title XI, §1106; not yet included in the U.S. Code	Nature-based feature	BOR	“The term ‘nature-based feature’ means a feature that is created by human design, engineering, and construction to provide a means to reduce water supply and demand imbalances or drought or flood risk by acting in concert with natural processes.”

Source: CRS from Congress.gov and Office of the Law Revision Counsel, United States Code.

Notes: USACE=U.S. Army Corps of Engineers; EPA=Environmental Protection Agency; BOR=Bureau of Reclamation