Healthy Wetlands, Healthy Watersheds

Leveraging state wetland restoration and protection programs to improve watershed health.

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Leveraging State Wetland Restoration and Protection Programs to Improve Watershed Health

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Executive Summary

Integration is a form of synthesis – the act of combining various elements into a harmonious whole. For example, the human body is an incredibly sophisticated and complex integration of multiple systems, including circulatory, digestive, endocrine, exocrine, immune, muscular, nervous, renal, reproductive, respiratory and skeletal. When one system is impaired or doesn't function properly, it affects the integrated whole – physically, mentally and emotionally. So too, have we begun to understand the physical, chemical and biological systems of the earth. The manner in which wetland managers approach wetland protection and restoration has changed over the last 25-30 years to incorporate a systems approach, recognizing that wetlands are a component of watersheds, and thus elements within the watershed, but perhaps external to a specific wetland site, need to be integrated into wetland restoration projects. This was one of the most significant findings in a 2017 ASWM white paper, entitled *Wetland Restoration: Contemporary Issues and Lessons Learned*.

Similarly, on the programmatic side, ASWM completed a *Status and Trends Report on State Wetland Programs in the United States* in 2015and one component of that study looked at ways in which state wetland programs were integrated into other state agency programs. What we found was that in many cases, states were already doing this. The most common type of integration was with stormwater management (37 states), followed by watershed management (34 states) and flood/hazard control programs (26 states). Coordination activities were found in some states with the state's Total Maximum Daily Load (TMDL) program (22states). Finally, the formal inclusion of wetlands in two selected state-level resource plans: Wildlife Action Plans (22 states) and Statewide Outdoor Recreation Plans (9 states) was less common and scattered across the nation.

Nature-based approaches for water quality, hazard mitigation, climate change, biodiversity, economic growth, agricultural productivity and other issues have received a significant amount of interest and support in recent years. But few studies have been performed to analyze how these approaches have been implemented, what the barriers to success may have been, and what kinds of lessons learned can be shared for others interested in pursuing a nature-based approach. Justification for integration can come in many forms, but one of the most widely accepted methods is via a benefit-cost analysis. However, many wetland benefits are unaccounted for in the market system, so accounting for them in a traditional benefit-cost analysis can be tricky. Because of this, other measures of the benefits and costs of integration have typically been used.

This white paper captures and provides in-depth analyses of eight state program integration case studies as well as nine on-the-ground watershed projects to identify what worked, what didn't work, what some of the barriers to success were, how those barriers were circumvented and lessons learned that can be shared. ASWM hopes this study will result an increase in state and tribal wetland program capacity to implement and support regional, state and local efforts to restore, enhance and create wetlands for the improvement of overall watershed health and increased resiliency. And in the end, we believe the public will benefit from the completion of more successful, cost-effective public and private wetland restoration, protection and hybrid green infrastructure projects, leading to improvements in aquatic and ecosystem resources.

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Photo Credit: US Fish and Wildlife Service

Introduction

Background

Healthy wetlands are an integral component of healthy watersheds and provide many essential ecosystem services. Increasingly efforts to protect, restore, enhance and create wetlands are being employed to improve overall watershed health and to support climate change adaptation and resiliency. However, there are substantial challenges to overcome. Ecological restoration in urban environments, whether of a wetland or a neighborhood stream, presents a unique set of challenges for those willing to take on such a project. As such, the objectives, design, implementation and assessment methods are by necessity different from ecological restoration projects sited in more rural environments and require a careful evaluation of trade-offs within watershed approach. Both traditional and innovative wetland protection and restoration projects - including hybrid systems using green infrastructure – are being increasingly employed to support overall watershed health and to provide increased flood and drought protection, provide clean drinking water, and maintain habitat under changing climatic conditions and land use scenarios.

To efficiently develop these projects, however, the various programs that manage wetlands, water quality, flood protection, habitat, etc. need to find innovate ways to integrate their efforts on administrative, programmatic and project levels. The benefits of integrating these programs will provide strategic opportunities to maximize multiple ecological benefits along with program efficiencies. For example, the pollutant filtering functions of wetlands can support §319, stormwater and TMDL program goals by

substantially reducing nonpoint source pollution while simultaneously providing other important functions such as flood attenuation or groundwater storage.

In 2016, the Association State Wetland Managers (ASWM) initiated a project with funding from a U.S. Environmental Protection Agency Wetland Program Development Grant and support from the McKnight Foundation to explore the various ways in which states and tribes are currently integrating state and tribal programs and/or using traditional and hybrid wetland restoration techniques to improve watershed health, identify the benefits and/or potential drawbacks of such an approach, and identify any ecological, regulatory and programmatic barriers to using these techniques. The primary goal of this project was to identify effective ways to integrate state and tribal wetland programs with other federal, state and local water, habitat and floodplain programs in order to leverage the benefits of wetland protection and restoration to improve overall watershed health.

To accomplish this goal, ASWM convened a national interdisciplinary workgroup consisting of experts involved in the various aspects of watershed health, including state wetland and water program managers, federal agency representatives, private consultants, and professionals from other nonprofit organizations and academia.

ASWM's Healthy Wetlands, Healthy Watersheds Project

Identifying solutions to the various challenges associated with watershed management will support improvements in state wetland programs, including each of the four core elements. For example, developing an integrated program that combines monitoring efforts for wetlands and surface waters can reduce long-term monitoring expenses, support more efficient monitoring and assessment programs, quantify how wetlands protect broader aquatic ecosystems, and spur the development of wetland water quality standards.

Identifying effective regulatory frameworks capable of supporting integration will benefit both compensatory and voluntary restoration and protection programs. This work supports implementation of Clean Water Act goals by increasing the efficiency within and among different permitting agencies, including CWA §401 certification, and the frequency that wetlands protection, restoration and creation are used to meet the objectives of other CWA programs. This project has been designed to assess the capacity of states and tribes to address pressing watershed issues by, a) providing case studies on projects that have improved watershed health through both traditional and hybrid wetland restoration and protection approaches; b) providing guidance for addressing watershed needs through traditional and hybrid wetland restoration and protection projects; and c) providing a framework for greater

Photo Credit: Vermont DEC

communication and collaboration among wetland restoration/protection, water quality, habitat and climate preparedness programs.

ASWM's Approach to "Unpacking" Integration in Ways that Inform State and Tribal Capacity Building Efforts

In order to increase the use and effectiveness of nature-based solutions, such as wetland restoration to improve overall watershed health, it is imperative to identify the multiple considerations and factors involved in watershed restoration including programmatic, regulatory and ecological barriers that may impede implementation so that they can be effectively addressed.

While there are many studies that discuss the science behind improving restoration, enhancement and creation outcomes, few focus on the process of program integration and collaboration to enable the full use of wetland restoration and protection for watershed health. Understanding the attributes of successful integration is key to helping states and tribes develop the framework in which they can develop effective integration efforts. To this end, ASWM performed outreach to states that have developed integrated programs (i.e. coordinating stormwater, wetland, and §319 programs) for addressing watershed health and identify common factors that may be integral to success. This analysis was also informed by ASWM's recent national state wetland program status and trends report and existing collaboration framework literature.

One of the biggest challenges to program integration for watershed health is regulatory frameworks that are often designed for traditional gray infrastructure. At the same time, the project highlights potential limitations due to conflicting program needs. Recognizing competing needs can help guide project planning in a mutually beneficial and permittable manner. Once the barriers to natural and hybrid solutions for watershed restoration were identified, ASWM worked to identify solutions and share practices to encourage the use of wetland-based strategies for improving watershed health and project outcomes.

Findings from this research have been summarized into this white paper, which outlines the project's findings and provides a road map for future efforts to improve watershed health through integrated programs and nature-based wetland solutions. ASWM developed nine integrated project case studies, eight state program integration case studies, watershed project one-page highlight sheets and supporting data sheets, and other useful materials that support the white paper's analysis (see appendices).

Additional Project Components

Additionally, ASWM coordinated the delivery of seven project-related webinars hosted via the Natural Floodplain Functions Alliance (NFFA) over the two-year period of the grant. These webinars showcased specific innovative approaches, proven successful strategies, case studies and other techniques that employ wetland restoration and other nature-based solutions for on the ground projects to improve watershed health. The NFFA is an affiliation of nonprofit and private organizations, government agencies and individuals dedicated to the protection and preservation of the natural functions of floodplains, including coastal areas. NFFA was established to promote, protect, and enhance the protection, restoration, and management of natural floodplain resources and ASWM is one of its founding members. These webinars are now available in ASWM's webinar archives and on the project online resource page

for anyone interested in learning more about the use of wetland restoration and protection to improve watershed health. ASWM also provided forums for discussion of effective program integration opportunities at the ASWM State/Tribal/Federal Coordination Meetings in 2017 and 2018.

A section on program integration for watershed health has been developed and made available to users on the ASWM website at www.aswm.org. ASWM has encouraged discussion and dissemination of information through partners, such as the Association of State Floodplain Managers, the Association of Clean Water Administrators, the American Planning Association, The Nature Conservancy and others, as well as through digital and social media, e-zines, newsletters and materials developed to communicate the benefits of wetland restoration and protection for watershed health to the general public.

State Program Integration Case Studies

The first set of case studies addresses what context and supports improve internal integration of agency programs at the state or tribal level. ASWM's program integration case studies showcase examples of states that have developed integrated programs to address broader management goals they have in common or that are complementary to each other.

Case Study Selection Criteria

ASWM conducted eight case studies of state program integration efforts selected from across the United States. Criteria for case study inclusion required state program integration projects to include a state wetland program actively integrating with one or more additional resource management programs operating within their state. Integration efforts had to have identifiable direct or indirect impacts from integration on watershed-level planning/implementation and documentable outcomes using formal or informal performance measures. Preference was given to case studies that could provide cost-benefit insights.

Case Study Characteristics

Integration projects were selected to represent a range of types of integration. The goals of these integration efforts included integrating wetland program efforts with stormwater, groundwater appropriations and surface water permitting, watershed planning, fisheries and recreation, nonpoint source pollution planning, cross-agency monitoring and Total Maximum Daily Load (TMDL) implementation.

States included in the case studies include Indiana, Minnesota (2), Missouri, Nebraska, New Mexico, and Vermont (2). Selected case studies ranged in age from three to twenty-two years since their start. Case study projects were in various development phases at the time of analysis, with some in early phases of implementation and others in second or third iterations of project activities and monitoring.

Content of Program Integration Case Studies

Case studies include two types of information: 1) contextual information and 2) in-depth information. Contextual information is critical to understanding what conditions were in place that may have had an influence on the success of the project, as well as allowing readers to better understand how each state's circumstances are alike or different from their own.

Contextual information includes information about the state wetland program, the type of integration activity that was undertaken, the scale of integration, integration goals, the timeline for integration, project leadership and resource investments to support the integration effort.

In-depth information was captured in each case study on how success has been measured to date, the results of integration efforts (outputs and outcomes), information about the costs and benefits of the integration actions, policy-related supports and considerations, challenges and lessons learned.

Additional information, when available, was included on the potential transferability to other states, next planned steps for the effort, contact information and links to additional resources for those interested in learning more.

Needs and Challenges Addressed

While environmental objectives such as improved water quality, increased wetland function or restored fisheries are important outcomes, internal integration of agency programs at the state level were often aimed at achieving broader management goals. Many of ASWM's program case studies identified integration as a tool to address common challenges to watershed level management including redundant processes, limited resources, siloed workflows and poor inter-agency communication. Through integration state program leadership sought to (1) improve planning, management and assessment activities, (2) increase effectiveness and efficiency of permitting, monitoring and enforcement, and (3) identify opportunities for collaboration and resource-sharing. For example, Indiana's program integration efforts were designed to better support the regulated community by increasing its capacity to process permit applications, streamline compliance measures, and respond to permittee questions and complaints in a timely manner. Both Missouri and Nebraska utilized program integration to meet ongoing programmatic needs, share knowledge and expertise, and pool funding for joint projects when appropriate.

Photo Credit: MNBWSR

State Program Integration Case Study Snapshots

The project developed eight case studies (Appendix C) focused on state program integration. Case studies were selected to represent a continuum of levels of effort and formalization. One case study provides an example of nominal-level, more "opportunistic" integration through coordinated cross-agency planning. Four intermediate-level integration case studies range from wetlands being part of a larger reservoir rehabilitation planning initiative to including wetlands in multiagency, watershed-level plans, and considering wetlands in other permitting efforts.

The remaining three case studies focus on comprehensive-level integration, where permitting monitoring and permitting activities that once were independent have formally been housed and re-envisioned into new, combined services. This last category requires the most internal commitment and formalization, as once disparate practices had to be reconciled and new systems created to replace existing ones.

The following list outlines the focus and content of the eight state integration case studies along an integration continuum.

Nominal-level Integration Activities

1. **Cross-Agency Planning to Identify Integration Opportunities:** Missouri's state wetland program coordinates quarterly meetings to bring together other state agencies to brainstorm opportunities for opportunistic collaboration and resource-sharing.

Intermediate-Level Integration Activities

2. **Reservoir Rehabilitations including Wetland Restoration for Fisheries and Recreation:** Nebraska has integrated wetland restoration work into the state's successful reservoir rehabilitation program.
3. **Watershed-level Planning Adopted at the State Level:** Minnesota's "*One Watershed, One Plan"* initiative coordinates aquatic resource management at the watershed level across the state.
4. **Wetlands Integrated into Nonpoint Source Pollution Planning:** New Mexico has developed Wetland Actions Plans to inform nonpoint source planning in the state.
5. **Integrated Groundwater Appropriations and Surface Water Permitting:** To address concerns about groundwater withdrawals and their effect on surface waters, Minnesota has developed a new integrated permitting system that includes wetlands.

Comprehensive-Level Integration Activities

6. **Integrated Water Quality Monitoring Programs across Resources:** The State of Vermont has integrated its water quality monitoring programs (including wetlands) in the state to improve planning, management and assessment activities.
7. **Achieving TMDL Phosphorus Reduction through Wetland Restoration and Protection:** The Vermont Wetlands Program is leading an integration effort to achieve no net loss of wetlands or wetland function as a component of the Lake Champlain TMDL.
8. **Integrated Stormwater and Wetland Permitting:** Indiana has brought together and integrated all wetland and stormwater permitting activities under one section of their state agency to increase effectiveness and efficiency of these permitting activities.

Photo credit: Vermont DEC

Watershed Project Integration Case Studies

ASWM's project also looked at integration efforts that expanded beyond state agencies and focused on the project level. ASWM created nine watershed project integration case studies to explore key elements of successful on the ground projects that improved watershed health through traditional and hybrid wetland restoration and protection techniques. These projects all included state (and in some cases tribal) partners but required integration among disparate parties that included state agencies, federal agencies, regional and local government, nonprofits, consultants, private businesses, academia and others.

Criteria for Case Study Inclusion

Integration efforts were selected from across the United States. Criteria for case study inclusion required eligible projects to address a regional or statewide watershed issue and involve multiple partners within an overall team. Selected watersheds were at least 50 acres in size and included a wetland system within their boundaries. Projects were required to include at least one of four techniques; wetland restoration, creation, enhancement and/or protection. Finally, projects must be designed to result in multiple benefits across the watershed.

Case Study Characteristics

To capture a diverse set of case studies, integration projects were selected from across the U.S. involving watersheds in Florida, Iowa, Minnesota, New Mexico, the New York / New Jersey / Pennsylvania / Delaware region, Oregon, Texas, Washington D.C, and Washington State. Selected watersheds were broken into size categories based on acreage ranging from small (2), medium (3) and large (4).

The smallest watershed included in ASWM's study was the Beaver Creek Watershed in Iowa (11,328 acres), the largest was the Delaware River Basin which encompasses terrain in four states (8,664,960 acres). Analysis of these case studies reveals that watershed size does not appear to be an indicator of the number of partners engaged or the benefits achieved through project integration. Most of the selected watersheds include both rural and urban settings, with eight specifying rural regions within their watershed and seven containing some urban areas. While all nine of the case study watersheds included an inland setting, only one case study, the Delaware River Basin, included costal land. Despite variation in watershed settings and size, the types of projects being implemented in these case studies were consistent with eight of nine watersheds utilizing wetland restoration, enhancement and protection techniques. Only case studies from Iowa, Oregon and D.C. cited wetland creation projects as part of their watershed management efforts.

Case study projects were in various development phases at the time of analysis, with five in the midst of implementation and four fully immersed in monitoring activities. Planning periods varied significantly across case studies and did not appear to be correlated to watershed size. Some, such as the Lewisville Lake project and the Yakima River Basin, spent between two and five years in the planning phase, while others spent well over ten years designing and redesigning projects based on shifting needs and policy requirements. For example, the Upper St. Johns River Basin project was initiated 1957 but construction didn't begin until 1988 due to changing project requirements and ownership. More than half of the projects included an implementation time frame of ten or more years with ongoing monitoring efforts. The length of time dedicated to these projects demonstrates that watershed-level work is a time-intensive and lengthy endeavor. The Yakima River Basin Plan in Washington for instance, lays out a 30-year strategy designed to improve the watershed while responding to changing needs.

Needs and Challenges Addressed

Diverse motivations existed for conducting watershed-level projects throughout the case studies. The most commonly cited objectives were improving water quality, flood and drought control, reducing pollution and stormwater runoff, restoring and protecting natural resource functions, and increased recreation and public access. Each of the projects involved transboundary considerations and coordination, requiring multiple levels and types of access to achieve their goals, regardless of size. The smallest watershed included in the study, Beaver Creek, required work to be coordinated among three water districts, while the largest, the Delaware River Basin, managed efforts spread out over four states. It is also important to note that in addition to the complex environmental issues the case study projects were designed to address, each included highly social elements bringing people together to jointly work on issues that often had the potential to be complicated and contentious. Examples of some specific, potentially contentious issues addressed by the case studies that require special attention to social dynamics include addressing water conflicts, identifying high runoff areas and pollutant contributors, addressing flooding/drought conditions, analyzing trends, unpacking equity issues and community building.

Project Partners

Watershed projects, by their very nature, usually include diverse partners. All nine-watershed project integration case studies included partners from state and regional government agencies. Six case studies featured partnerships with federal agencies and academic institutions, while five worked with local governments. Additional partners included nonprofits, consultants, stakeholder workgroups, private landowners and tribes. The state of Washington for example collaborated with the Yakima Nation as part of the process in developing its 30-year vision for the Yakima River Basin.

Photo Credit: US Fish and Wildlife Service

Watershed Project Integration Case Study Snapshots

The project developed nine case studies focused on addressing a regional or statewide watershed issue. Case studies were selected to represent a range of watershed sizes and issues, with two case studies providing examples of small-scale projects focusing on watersheds under 100,000 acres in size, five midsized case studies looking at watersheds greater than 100,000 acres but less than 1,000,000 acres, and two large-scale case studies examining watershed projects over 1,000,000 acres.

Small-Scale Watershed Projects

1. **Beaver Creek Watershed (11,328 acres):** The Iowa Watersheds Project created and enhanced six wetlands in the Beaver Creek Watershed for the primary purposes of flood mitigation and nitrogen removal.
2. **Johnson Creek Watershed (33,280 acres):** The State of Oregon is working to restore natural resource functions such as flood storage, water quality benefits, and fish and wildlife habitat within the Johnson Creek watershed through wetland creation and restoration, enhanced protection, and public outreach.

Midsized Watershed Projects

3. **Anacostia Watershed (112,640 acres):** The Anacostia Watershed Restoration project in Maryland was designed to address pollution concerns resulting from uncontrolled stormwater runoff and includes plans to protect, restore, and create wetland ecology in the watershed.
4. **Upper St. Johns River Basin (160,000 acres):** The St. Johns River Management District and the U.S. Army Corp of Engineers have worked to reclaim and restore the historic floodplain of the Upper St. Johns River Basin for the primary purpose of providing better flood protection while also improving water quality and restoring natural habitat functions.
5. **Vermillion River Watershed (214,000 acres):** The Vermillion River Watershed Joint Powers Board in Minnesota has addressed concerns regarding water quality of surface and groundwaters and watershed sustainability and resiliency through restoration, enhancement, and protection of 60 wetlands in 8 high priority sub watersheds.

6. **Lewisville Lake Watershed (619,522 acres):** The Upper Trinity Regional Water District in Denton County Texas is working towards improving water quality and protecting natural habitats through public education, conservation techniques, and coordination with city and county officials to develop best management practices.
7. **Jemez River Watershed (661,760 acres):** The Jemez Watershed Group has worked in coordination with public and private parties to improve the Jemez River through wetland and riparian area restoration techniques.

Large-Scale Watershed Projects

8. **Yakima River Basin (3,936,000 acres):** Washington State has developed the Yakima Basin Integrated Water Management Plan to address concerns regarding wildlife habitat and water resource availability over the next 30 years.
9. **Delaware River Basin (8,664,960 acres):** The Delaware River Watershed Initiative brings over 50 organizations together to improve the quality of aquatic ecosystems within the Delaware River Basin through restoration, protection, public outreach, and coordination of public and private groups.

Photo Caption: Washington State DNR

Capturing the of Benefits of Integration

All seventeen case studies reported achieving important benefits that outweighed the costs of the activities; however much of this information is anecdotal. Very few case studies (3/17) had conducted a formal benefit-cost analysis for any of their integration activities. This did not mean that benefits and costs were not understood or valued by the coordinators or the state.

For watershed project integration case studies, leading benefits included improved water quality (9), increased public access, recreation, awareness and stewardship (8), flood or drought control (8), improved hydrologic conditions (7), wetland restoration (6) and increased biodiversity/ecological productivity (5).

Other specific environmental benefits included: pollution reduction/stormwater controls; nitrate reduction; reduced impairment; better wetland function; increased water storage (groundwater, surface water); improvements to wildlife habitat; and increased biodiversity and abundance/size of species. Examples of these benefits can be found in the Anacostia watershed case study where integration efforts focused on reducing stormwater pollution, in Vermont's efforts to integrate wetland restoration into Lake Champlain's TMDL, and in Nebraska's measurable improvements to biodiversity through reservoir rehabilitation. Additional monetary benefits included: improved property values; infrastructure savings, revenue from recreational activities; contributions to agricultural production (irrigation, freeze protection); and green jobs (hotels, restaurants, shops, gas stations, etc.). The Beaver Creek case study highlights such outcomes where increased flood control was achieved through the restoration of six wetlands within the watershed. Some commonly identified non-market benefits included increases or preservation of aesthetic value, improved information sharing, better decision-making, increased educational opportunities, as well as preserved cultural and spiritual values.

Additionally, states reported improved restoration potential, increased ability to achieve agency goals, greater resource sharing that led to higher quantities or quality of projects, and increased access to critical pools of expertise. This was the case in Missouri where informal quarterly meetings of representatives from stakeholder agencies has led to increased collaboration, shared funding resources, and expanded

opportunities to insert wetland protection and restoration into existing initiatives. Specific case studies identified increased use of public resources and recreational activity, improved ability to more accurately identify high need areas for protection or restoration, greater efficiency in the use of field staff, and new career development opportunities through the sharing of knowledge and skills. Examples of these kinds of benefits can be found in the Indiana case study where the merger of wetland and stormwater departments reduced the wetland permitting process from 30 days to 12 and doubled their on the field staff through cross training, as well as Nebraska where increased recreational use of restored reservoirs became a hallmark of the project.

However, missing from many reports on benefits were measures of the collaboration/ integration efforts themselves. The peer reviewed and gray literature are full of findings about how the act of working jointly can be measured, as well as how to develop metrics to look at those specific costs and benefits. When the collaborative outcome on the environment may be challenging to capture or attribute specifically to the project, the ability to measure the value of what specifically emerges from joint action becomes increasingly important.

Among the case studies, findings show that costs are generally focused on covering the basic costs of the activities (staff time, meeting space, materials, incentives for participants, etc.) and are usually shared between partners, though some may have more contributions that are in-kind than cash investments. The benefits of these integration activities are wide-ranging and focus on creating shared understanding and goals, leveraging funding and other resources, having greater reach and impact, the ability to address larger, watershed-level issues, and increased public awareness of and appreciation for watershed projects.

Photo Credit: IDNR

Another benefit of integration can be new opportunities for innovation. By bringing together partners to address issues in novel ways and with shared expertise and resources, innovation can be either a focus or a byproduct of these activities. Examples identified by the case studies include: 1) partnering with a university to place real-time sensors that deliver data live to researchers, project administrators and the general public through a new online portal, 2) creating innovative semi-structural water management designs to replace highly structured designs, and use of new models, such as the Hydrologic Vegetation Prediction Model.

Most case study respondents indicated that having this information more formally would allow them to look at the larger picture and target inputs better, as well as make the case for ongoing or additional integration efforts. Staff indicated that this kind of valuing is essential for promoting the transfer of these efforts to other agencies, states and tribes.

A combination of case study analysis and review of the literature led to the development of a list of Umbrella Cost and Benefit Categories:

Umbrella Cost Categories

- Start-up and meeting costs
- Staff time reallocation
- Creation of shared or complementary systems
- Cross-training
- Sometimes incentives or paying into a shared pot of funds for integrated activities

Umbrella Benefit Categories

- Improved efficiency
- Better products and services
- Increased reach and depth
- Increased access to resources
- More buy-in
- Stronger relationships/resiliency

New Resource Available to States and Tribes

Having identified a pressing need by states and tribes to better understand how to translate general categories of costs and benefits from integration into operational evaluation metrics, ASWM has developed a supporting resource on "*Capturing the Value of Integration: Considering Benefit-Cost Measures When Making Decisions about Integration Activities*" that is can be found in Appendix F.

Photo Credit: Vermont DEC

Barriers to Implementing Nature-based Wetland Solutions

Wetlands are part of the natural landscape. Historically 50% of the wetlands in the lower 48 states have been lost and many more have been altered, degraded and otherwise impacted by anthropogenic activities over the past 200-300 years. It is not surprising, then, that returning healthy wetlands to the landscapes across the country has the potential to address degradation and pollution problems that now occur where wetlands previously existed. However, many programs were developed with a focus on alteration to existing systems: straightening streams, isolating wetlands in the landscape, building levees and impoundments and similar activities that may be cost effective in the short term. Such activities require reconstruction, expensive maintenance and experience occasional catastrophic failures.

In recent years, more attention has been directed to opportunities to incorporate nature and nature-based solutions that provide the potential for more stable, less expensive long-term tools to address these ongoing issues. Because natural landscapes, including wetlands, have not been part of the solutions, there are often barriers that make it difficult to integrate wetlands into programs where they could potentially provide significant benefits.

Barriers to integrating wetland protection, management and restoration strategies often fall into one or more of four primary barrier categories – programmatic, regulatory compliance, benefit-cost analysis of nature-based solutions, and scientific uncertainty.

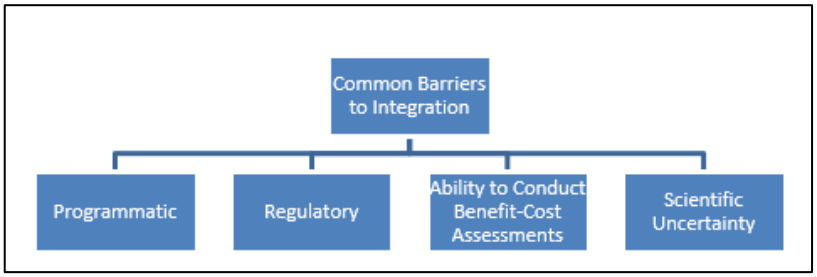

Figure 1. Common Barriers to Integration

Photo Credit: NRCS

A. Programmatic Barriers to Integration

Coordination between government agencies can be very hard, especially in highly distributed regulatory/management systems. Working across programs and adoption of integrated approaches are key to adopting nature-based solutions that include wetlands. However, siloed program structure, political will to change management systems, disconnected communications between parties, and a lack of formal structure capable of facilitating collaborative work are all common barriers to integration activities, among others. Most barriers to integration fall into this category.

Many aquatic resource programs were created decades ago and developed to address a specific issue or problem in isolation from other programs. These programs were designed with little understanding of other programs that, today at least, address the same resource for different reasons (river flooding vs. river pollution, habitat management vs. endangered species).

Over time changes in land use practices, the growth of cities and migration of much of the U.S. population to the coast led to changes in the scope of programs. Additionally, advances in science, technology, and mapping have established a greater and more nuanced appreciation of the substantial benefits achievable through integration. As a result, existing programs and missions may not be structured in ways that allow for, or at least make possible, reaching across programs to have greater impact. At the time programs were created, populations impacted may have been smaller and the practices regulated may have been much different, while the reach of programs may have been much narrower. This siloed structural approach has encouraged continued isolation due to different program purposes, specialized disciplines and the evolution of unique terminology used by different experts.

This project identified several specific programmatic challenges that were common to most of the case studies. They are listed below, along with specific examples of limitations they create:

1) **Getting the Conversation Started:** Most of the case studies identified an initial and often continuing challenge of working across political and organizational boundaries. For state agencies, this manifests as challenges breaking down agency and programmatic silos. With watershed projects, it manifests as a challenge having partners think at the watershed level, across political or geographic

boundaries. This was especially true in most cases at the beginning of the project, when parties were vested in their own organization/agency goals and activities.

2) **Structure:** In many state programs and watershed projects, an organizational framework does not exist or only minimally exists for incorporating wetlands beyond basic regulatory requirements (e.g. §401 certification). Wetlands don't easily rise to the top of competing priorities in projects that address multiple problems. Additionally, collaboration requires the development of formal or informal structures to facilitate joint action. Organizational structures for this integration work can be inadequate or too cumbersome, leading to problems making decisions, dealing with conflict or completing the work.

3) **Collaboration Building:** Across the board, integration research and ASWM's case studies find that time committed to carefully building the relationships and structure involved in integration is one of the key elements of success. Integration takes careful planning and investments in building bridges between programs, people and sectors. Projects and programs that have invested time and resources in collaboration building as a task in and of itself generally have a greater likelihood of success.

4) **Measuring Collaborative Action:** The definition of collaboration is often captured as "more than the sum of its parts." One of the challenges of this integration work, consequently, is that it can be hard to measure an integration projects' specific environmental outcomes, which are usually part of a larger suite of activities happening to address the issue. Capturing what led specifically to a change is hard to capture. There is limited understanding about how to measure the actual work of integration and collaboration, in addition to the environmental impacts from these activities. However, the ability to measure these elements is critical to showing their value.

5) **Information Exchange and Communication:** Most projects report a need to invest in more coordinated information exchange and communication between program offices involved in ongoing or potential integration activities. Technical language and conceptual differences can create misunderstandings and confusion. Water quality agencies and water quantity agencies (e.g., state floodplain and natural hazard mitigation agencies) frequently do not communicate and coordinate their activities and are provided with little incentive to do so. Additionally, communication and sharing opportunities are often not maximized or funded for grant recipients or between different levels of government.

6) **Public Awareness:** A lack of public awareness about both the problem and the options for nature-based solutions serve as major barriers to action. Without support from the public and other potential partners, integration is often seriously hampered, if possible at all. Findings from the project integration case studies also show that the many issues that watershed integration projects are designed to address often involve highly complex social issues as well, making meaningful public engagement opportunities even more important.

7) **Integration Policies:** It can be difficult to establish standardized policies for integrated activities. However, if, for example, stormwater and wetland permitting are not integrated, it can slow down approval processes for many projects. (See Indiana case study for an example of how to overcome these barriers.)

8) **Cost:** The development of integrated approaches can require a reorganization or restructuring of regulatory or resource management programs. They may also require investments in incentives. While these costs are often recouped or exceeded over time, they require initial outlays that may be an issue. Some types of planning may also be limited by the prohibitive cost of purchasing and/or using geospatial software such as ArcGIS, particularly for local governments and watershed groups.

9) **Understanding of Complexity:** The complexity of interwoven environmental, organizational and economic needs almost always involved in integration activities can make the coordination of successful integration activities especially challenging. Working to "unpack" and understand the complexity and all the moving parts is often not given the time and thought required to create systems and programmatic accommodations necessary to conduct integration work effectively. Grants to fund integrated projects require long-term planning and the complexity of the projects create additional challenges to qualifying for and securing funding and then spending it within time constraints that may be imposed.

10) **Programmatic Uncertainty:** Federal, state and local programs change over time depending on the priorities of newly elected officials, community needs, new technologies and funding availability. These create additional levels of complexity that must be addressed in program planning. It is not always clear where roadblocks are or will be in integration efforts. In a complex effort there are many moving parts and specific program requirements to address.

11) **Acknowledging Limits:** Many case studies indicated that they were regularly being asked to accomplish additional goals that were beyond the scope of their workplan and/or resources. Without an understanding of the resources and goals of the project/program, partners and the public may have unrealistic expectations, resulting a feeling of disenfranchisement with integration efforts.

Photo Credit: US Fish and Wildlife Service

B. Regulatory Compliance and Integration

Regulatory programs are often designed to address a project that would harm a resource rather than anticipate the need to review projects designed to enhance, manage or restore that resource. Permitting may not be structured to facilitate nature-based solutions or encourage them.

Projects and actions that integrate wetland restoration, protection and management to achieve the goals of other programs may also require compliance with regulatory program requirements. These regulatory programs were generally designed for projects and activities that degrade and destroy natural resources such as filling and dredging wetlands, raising flood heights or altering habitat critical to endangered species. The architects of these programs did not anticipate projects designed to restore, often only partially, altered landscapes. The criteria established to protect natural resources may create barriers to restoring them, particularly in highly altered areas where projects may represent only partial restoration and/or even establishment of new and different wetland types because watershed changes (stream channelization, wetland drainage, impervious surfaces, etc.) make traditional restoration impractical. In addition, programs that would potentially benefit from incorporation of wetland restoration and nature-based solutions (to address pollution, flooding etc.) may themselves still adopt actions that further the loss and degradation because of inadequate wetland protection programs.

This project identified several specific regulatory challenges that were common to most of the case studies. They are listed below, along with specific examples of limitations they create:

1) **Federal Inconsistency:** Clean Water Act §404 permit requirements for similar projects vary from one Army Corps district to another for both individual and nationwide permits for similar projects.

2) **Project Coordination:** It is often challenging to coordinate permit review among state and federal agencies responsible for reviewing projects with multiple authorities, e.g., NEPA, coastal zone, dredge and fill permitting, §401 certification, etc.

3) **Regulatory Compliance Requirements:** It can be challenging for wetland regulatory programs with a small number of staff to have the time and knowledge resources necessary to meet regulatory requirements, such as compliance with NEPA and Cultural/Historical Preservation requirements. Additionally, FEMA letters of map revision are generally required for restoration and dam removal projects that either increase or decrease base flood elevation levels. The map revisions are expensive to perform and may result in significant processing and review fees. They may also need to be correlated to out-of-date engineering studies that are often not available.

4) **Resource Availability:** Resources available to assist state agencies in assessing and understanding proposed integration projects are sometimes limited. For example, state wetland maps may be incomplete or out of date. Similar issues often exist for federal GIS layers.

5) **Regulatory Framework:** Compensatory mitigation regulations anticipate mitigation for wetlands or streams but not wetlands and streams together. This creates challenges for mitigation banking efforts to restore watersheds as a whole when they cannot use a cross-program crediting system. Also, when natural resources are part of a proposed solution, regulatory programs may not provide a logical framework for their evaluation. Lack of water quality standards for wetlands is problematic in different contexts across the country. For example, it is hard to recognize them as waters of the state and protect them when addressing TMDL's. There are substantial efforts nationwide to clean up nutrients and phosphorus from stormwater and agriculture runoff, and wetlands are sometimes identified as the place to direct run-off. Directing stormwater and agricultural run-off into natural wetlands (versus using wetlands as part of the solution) can be detrimental to a wetland's health and condition.

   Conversion of wetlands to salt marshes (marsh migration) also faces many regulatory challenges. Practices to support marsh migration are new and experimental and therefore unfamiliar to regulatory program staff. Infrastructure along coastlines, such as roads, bridges and buildings, create physical barriers to marshes' ability to migrate inward. And some restoration practices are interpreted as fill and are not normally accepted within the regulatory framework.

6) **Conflicting Program Interests:** Decisions about the most appropriate type of wetlands to support on the landscape are sometimes controversial. Often these occur when the proposal is to 'enhance' a wetland, changing it from one type to another. Historically, conflicts have occurred when an agency supported developing waterfowl habitat which led to changing a wetland rated as 'high quality' to 'low quality' in the context of another program.

7) **Project Boundaries:** Project boundaries within a watershed can span physical state boundaries and federal regulatory boundaries. For example, Army Corps District boundaries are aligned to watershed boundaries whereas state authorities are restricted to within state boundaries. Living shorelines present unique challenges with respect to who retains control where practices are carried out. When it's below the water lines it is the property of the state. If there are attempts to restore coastlines and areas where practices are applied change to above the water's edge it becomes the property of the landowner who may or may not continue the practices carried out by the states.

8) **Urban issues:** A high degree of alteration in urban systems can create substantial issues around compliance with local ordinances and land use plans. Additionally, the highly altered urban environment can make it improbable if not impossible to fully restore or protect a natural wetland as the environmental stressors are too intensely detrimental to sustain a natural system. Often in these cases, a hybrid approach that utilizes engineered green infrastructure solutions such as bioswales and rain gardens must be used in conjunction with protection and restoration of natural wetland and stream systems. Many local governments do not have the appropriate codes in place to address construction of green infrastructure systems nor the experienced staff or financial capacity to implement or maintain green infrastructure.

Photo Credit: INDNR

C. Benefit-Cost Analysis of Integration and Nature-Based Solutions

Evaluation criteria for assigning value to wetlands and other natural landscape features are often used in comparison to built or engineered solutions. However, the multiple ecosystem service benefits provided by wetlands are often not included in benefit-cost analyses.

Benefit-cost analyses (BCA)can be a valuable tool in quantifying the pros and cons of protection, conservation and restoration of wetlands. However, the tools and methodologies available to quantify the benefits (monetary and non-monetary) of wetland functions to provide benefits such as reduced drinking water treatment costs, flood protection, etc. are still in early stages of development and are not widely understood or employed. Much of this is because wetlands have not historically been identified as an inherent part of the strategy to meet state program or watershed-focused objectives. For example, wetlands attenuate flood waters but traditionally levees, stream alteration, elevation of buildings and similar actions have been the focus of flood control and floodplain management strategies.

While wetlands are characterized as the 'kidneys' of the landscape, their protection is often not part of water pollution prevention and control strategies either. Opportunities exist to protect and conserve wetlands for multiple benefits such as supporting instream flow, reducing erosion and sedimentation of streams and other uses. However, it is often difficult to justify green infrastructure solutions rather than more traditional grey infrastructure based on how benefit-cost analyses are traditionally conducted.

This project identified several specific challenges that occur using benefit-cost analyses to demonstrate the benefits of protecting, conserving and managing wetlands that were identified in the cast studies. They are listed below, along with specific examples of limitations they create:

1) **Urban vs. Rural Differences:** Benefit-cost analysis of wetlands can be favorable or unfavorable in rural versus urban areas depending on what is being evaluated. Restoration of wetlands in a rural area is typically less expensive than in an urban area and may achieve greater performance outcomes. The high cost of land acquisition and landscape alteration often make restoration expensive in an urban area. However, the benefits to the local urban community may be of great value to a greater number of people, particularly for historically underserved communities who have little access to nature or open space.

2) **Discount Rates:** There are no standardized discount rates for use in BCA for nature-based solutions. Applying the correct discount rate is also a challenge because discount rates are designed to control for the rate of time preference of individuals, not of society. In other words, an individual will value, say $100, more now than they would value it at a future time. To account for benefits that wetlands provide to society, a social discount function could be used instead, but there is still a significant amount of debate on the best rate to use. Determining the appropriate discount rate is a challenge and requires making many assumptions (e.g., people's future values).

3) **Federal Inconsistency:** Different federal programs such as FEMA, HUD and the USDA value impacts to human populations differently in benefit-cost analyses. It can be challenging to work across these different programs.

4) **Data Availability:** Data availability may be limited. For example, in one case study there were only three historic floods available to provide data in a community on the possible benefits of wetlands for floodwater attenuation. In this situation, trying to line up re-occurrence intervals for structural versus natural solutions was challenging.

5) **Cost:** Depending on the methodology used to develop a benefit-cost analysis, it can be an expensive endeavor. The benefit transfer method is relatively inexpensive to use versus creating new data via surveys, wetland assessments, etc. Financing challenges and lack of available funding to carry out benefit-cost analysis is a barrier particularly for lower income communities.

6) **Program Integration:** As discussed in other sections of this paper, benefit-cost analyses of collaboration and program integration have rarely been conducted, so without the burden of proof that efficiencies and savings have been realized, it can be very challenging to justify initiating program integration efforts

Photo Credit: Oregon.gov

D. Scientific Uncertainty and Integration

A growing number of studies show the ecological benefits of nature-based solutions. However, applied science practices associated with integrated approaches are often still viewed as highly innovative, out-of-the-box ideas, and results are not always well known or well-documented. Benefits of these projects are often known by the implementers, but not well-documented in reports or studies. This leads to interested staff feeling as though there is an element of risk associated with pursuing more environmentally friendly practices, despite evidence that these practices can significantly reduce risk and cost over time, when properly implemented and maintained.

Applied science drives innovation in many programs designed to protect human health and safety and the environment and has had a profound impact shaping these programs and enabling revisions and improvements in both understanding problems and identifying solutions. Often, however, knowledge lags behind need. And when new research has the potential to support development of improved solutions that leverage wetlands restoration and natural infrastructure integration into programs and projects, it is still very challenging to disseminate information and get it integrated into program delivery. Frequently, federal, state and local programs rely in part on grey literature because peer review for formal publication can take years. Thus, scientific knowledge may not exist, it may only exist in isolated areas, or it may be controversial and difficult to gain acceptance. For example, it has taken many years for the concept of gradually redirecting sediment traveling down the Mississippi river along the way to the Gulf of Mexico into adjacent marshes to gain acceptance, and it is taking longer still to implement.

This project identified several specific scientific barriers that impact the selection, planning and implementation of nature-based solutions. They are listed below, along with specific examples of limitations they create:

1) **Evolving Field:** Knowledge about how to restore wetlands to meet intended performance goals is evolving rapidly and not always widespread. The most frequent underlying cause for the failure of a wetland restoration project is that the site was not understood from the beginning: groundwater and surface water sources were not evaluated: soils were not confirmed on site; onsite and offsite stressors

were not identified and addressed, etc. This creates the potential for wetlands to fail to deliver intended benefits in integrated programs and projects.

2) **Knowledge Gaps:** More research is needed to address specific challenges. For example, many wetland restoration sites fail to accumulate organic matter at the same rate as existing sites. Scientists and practitioners are unsure why organic matter accumulation does not improve over time.

3) **Performance Metrics:** There is increasing interest in combining riverine/floodplain/wetland restoration but there is no consensus on the science-based performance standards and monitoring protocols that could be used.

4) **Resistance to Experimental Practices:** Practices such as salt marsh restoration practices are experimental; it is thus hard to incorporate them into a regulatory program framework.

5) **Access to Existing Information:** When research does exist, there is not always a clear path to get it to practitioners. Peer reviewed publications can be cost prohibitive as can expenses associated with attending trainings and workshops for professional development and knowledge sharing.

6) **Ecosystem Variability:** Aquatic ecosystem functions are highly variable depending on many factors, such as where they occur on the landscape, their ecosystem type (vernal pool, tidal marsh, lake, pond, river, etc.), surrounding land uses, and changing climate conditions and weather patterns. This means that a successful watershed restoration project strategy may work great in one part of the country but fail elsewhere. Understanding the types of systems in play and the watershed context is critical for developing a project that will perform as planned.

Policy and Administrative Supports to Facilitate Integration

Across both sets of case studies, the majority reported an important role for policy and administrative changes. Some changes entailed the passage of a bill, approval of an implementation plan or allocation of funding by the legislature. Other changes involved developing shared plans, adjusting existing regulatory instruments, developing joint agreements or changing the schedule of water releases.
The specific types of supports required differed between the two sets of case studies, in ways that might be expected. State program integration case studies needed more supports to enable formal internal joining of systems of and plans for shared management and action. Watershed project integration case studies required more supports that focused on creating inter-jurisdictional arrangements and multi-sector agreements. Across the board, the need for building administrative and organizational buy-in was key.

For state program integration efforts, necessary policy and administrative supports ranged from passage of legislation, to the buy-in of leadership and administrative staff, to agency changes and traditional ways of "doing business". All eight case studies reported some need for policy and administrative supports. In Vermont, these included the formal passage of a state-level Clean Water Act in 2015 that served as the primary driver for the integrated activities and increased protection of state wetlands through Vermont's Clean Water Bill. The state also made changes to its TMDL to include wetland restoration activities for TMDL compliance.

Multiple states relied on review of plans and management strategies from higher administration, usually at the commission/commissioner level. In New Mexico, the development of Wetland Action Plans and their approval as an alternative to watershed-based plans was at the crux of their integration activities. By shifting the focus of the plans, the state was able to start including more wetland restoration work into 319 projects and providing a more wholistic approach to restoration of stream corridors than before. The special nature of New Mexico's Wetland Action Plans limits the direct transferability of this approach to other states but lays the groundwork for other states to consider identifying and capitalizing on their own alternative plans, if approved by the Environmental Protection Agency.

Photo Credit: Ammodramus, Wikimedia Commons

Four watershed project integration case studies provided insights on policy changes and supports that were important to making the watershed approach possible. These included case studies in Minnesota, Oregon, Washington State, and the District of Columba. They range from passage of Senate bills to initiate a watershed project, to joint power agreements providing management structures among government entities, and a state-level executive order. In each case, the enacted polices were critical to the successful functioning of watershed-level activities.

Specifically, in the Anacostia Watershed, a Federal Executive Order was approved to implement their collaborative plan **(**13508 Chesapeake Bay Protection & Restoration Final Coordinated Implementation Strategy). In Oregon, House Bill 3441 was passed to provide guidance on the formation of watershed councils, necessary to support the structures needed to implement a watershed-based approach. In Washington State, legislation was passed to develop a plan and provide funding for the first phase of the Yakima River Basin integration project through the River Basin Water Resource Management Act. The Vermillion River Watershed Project in Texas was supported by three different policy changes: 1) the development of a joint powers agreement between several counties, 2) the passage of the Metropolitan Surface Water Management Act and, 3) new Metro Area Local Water Management Rules.

In addition to enacting policy, watershed projects can also benefit from administrative-level agreements with local levels of state and federal agencies. This was the case in Upper St. Johns River Watershed (FL) where project leaders worked with the Army Corps of Engineers to negotiate regulation schedules for the area when the risk of flooding is low. Together they establish a new Environmental Water Management Plan to direct operation of water control structures to optimize hydrologic conditions for wetlands.

Photo Credit: Vermont DEC

Integration Best Practices and Lessons Learned

Analysis of the seventeen case studies identified several important insights about best practices to encourage the use of integrated strategies including wetlands for improving watershed health and project outcomes. Best practices can help address ecological, programmatic, policy and regulatory barriers and identify implementable actions that can be taken to overcome them. The following practices are common to all the case studies and provide effective guidance for those considering integration efforts.

1) Adopt an Integration Mindset

In order to engage effectively in integration activities, partners need to adopt a mindset to being part of something larger. This means thinking beyond specific organization or agency goals and taking the time to develop strong shared goals and plans. The process of identifying overlapping goals and priorities is critical to partners' sense of ownership of the work and active participation.

2) Invest in Partnership Building

Efforts to develop effective partnerships and other relationship building activities should be taken seriously. Collaboration building takes time and commitment. It is not always easy. Planning in time for collaboration building activities is essential, as is the investment in resources such as neutral facilitators to ensure that all voices are heard and plans represent the voices and thinking of all, not just some, of the partners at the table. Partnership research shows that starting small and building on small successes is a "tried and true" method for building the trust and track record of success that leads to greater commitment and broader demand for integration services.

3) Engage Stakeholders Early and Often

Projects that engaged stakeholders early and often identified this effort as one of the key elements of their success. Generally, stakeholder engagement should occur at the planning, implementation, and review phases of a project or initiative. A strong example of stakeholder engagement can be found in the St. Johns River Watershed (FL) Case Study, which involved stakeholders at all phases of the project. They hosted agricultural stakeholder meetings on a regular basis and addressed the agriculture industry's

concerns with a Citizen's Technical Advisory Committee. Understanding that they needed to reach out to more than the agriculture community, they also held regular recreational public meetings to update stakeholders on land management and recreation issues. They also worked with select groups of natural resource stakeholders working to determine if land management planning objectives were being met.

4) Identify and Secure Sustainable Funding for the Lifecycle of Integration Efforts

All case studies indicated that either strong financial planning that allocated specific streams of funding for each phase of their work was critical or that they had encountered issues they had to overcome if funding had not been allocated for all phases, especially monitoring and evaluation. Projects that struggled in this area had initiated plans without securing additional funding for ongoing monitoring or wrap-up/reporting requirements.
It is critical to budget time and funding to support planning, implementation, monitoring, evaluation and reporting phases from the outset.

5) Secure Funding Support from Multiple Sources

All case studies linked together integration partners in ways that provided access to funding sources beyond the state's wetland program resources. Case studies showed examples of linking with local planning grants, securing state project funding not specific to wetlands, and incorporating wetlands into §319 projects. Most projects that engaged the public or watershed groups benefitted from offering those partners money or technical assistance (e.g. through planning grants, restoration support, or other).

6) Provide Formalization and Structure to Fit Scope

Structure is important. Case studies bear out the findings from integration and collaboration literature that show structure and formal process is essential to creating sustainable, smooth-running joint activities. The delicate balance with integration work is to make the structure and processes simple enough to facilitate action and progress but detailed enough to support the systems necessary to make decisions.

7) Develop Formal Systems for Prioritization Decisions

One of the case study staff members shared a useful quote: "All puppies are cute, but you can't bring them all home." Most integration efforts could address many different program goals. However, resources and capacity are often extremely limited. The case studies indicate that a primary factor of success was the ability to develop and effectively implement prioritization and decision-making systems. Additionally, in several case studies, the process of identifying and coming to agreement on priorities was affirming for the partners. Findings show that the act of prioritizing collaboratively can build relationships and networks (also known as "social capital"). Formalized systems are also important, as structured, well-documented decision making is critical to ensuring decisions and resource investments are defensible over time. Additionally, collaborative prioritization using pre-identified criteria based on achieving goals tends to maximize resource use by finding "the most bang for the buck."

8) Build-in Programmatic Adaptability and Flexibility

While having formal systems for prioritization was found to be critical to integration success, all case studies also emphasized the importance of flexibility. Integration efforts need the ability to adapt to changing circumstances and growth. Most case studies reported having gone through multiple iterations over time and benefitting from flexibility and adaptive management. The best laid plans can come unraveled, therefore it is important to remain flexible, adaptive and willing to compromise. One case study indicated that they had initially started with a highly complex decision-making structure that led to feelings of dissatisfaction and confusion. The collaboration had to be ended and restarted later with fewer key players and a simplified, formalized decision-making process that had been carefully thought out to make decision-making workable.

9) Invest in Public Outreach and Education

Another finding from analysis of the case studies was that most integration efforts required significant investments in public education or targeted outreach. Acceptance and support for integration projects require consensus that there *is* a problem in the first place. Once the external landowners, land trusts, watershed organizations or other organizational entities integral to the collaborative effort understand the value added from doing these activities, they usually want to get onboard. Those who are not convinced of the value of the effort from the outset especially benefit from learning about others who had experienced success. They prefer to initiate their engagement personally, rather than being told that they need to participate. For this reason, public education may benefit from documenting and sharing early examples of success and sharing those through strategic outreach and peer-to-peer sharing. Case studies also indicate that it can be useful to engage less-eager participants by providing examples of successful efforts. Several case studies cited the value of landowners witnessing benefits to neighbors from their integration work for them to get "onboard" with their projects.

10) Use Formal Measures of Integration to Demonstrate Integration Value

For the full value of integration activities to be measured, project managers should include other measures of performance beyond environmental outcomes and outputs like numbers of meetings conducted with stakeholders, etc. Integration and collaboration have a host of measures that should be considered when assessing the value of these activities, including measures of relationship building, formalization, increased access to resources, shared goal setting and others. These measures need to be learned and accepted by leadership from the start of a project, so that expectations of what will be accomplished and how it will be measured are agreed upon. Once identified, these measures should be integrated into formal metrics and built-in from the beginning planning stage so that they can be tracked throughout the life of the project and used for evaluation of outcomes. When designing monitoring and evaluation plans, think how data can be used in benefit-cost analysis and craft plans to support this additional work.

11) Manage Project Expectations to help Guide Perception.

Integration projects often require significant investments of time and resources, compromise, and create outputs and outcomes that extend beyond resource management goals. For partners, leadership and the public to have appropriate expectations of what will happen when, how funds will be spent and what they should expect to see as a result of these efforts, project managers should work to identify, develop and

share appropriate expectations. This work should be conducted as part of the partner planning stage and through stakeholder engagement and public outreach.

12) Plan for the End – Building in Strong Evaluation

For project success to be documented, it is critical to include measures that show what has changed from the beginning of the project to the its end. Measures usually focus on environmental outcomes and achievement of resource management goals. To this end, make sure not to gloss over the collection and analysis of scientific baseline data during the planning and early implementation phases of the project. To understand how far you have come, you need to understand where you started.

13) Work Towards Greater Understanding and Use of Benefit-Cost Analysis

Greater understanding and examples of BCA in application need to be developed and successfully used in multiple program settings to improve its role in breaking down barriers to nature-based solutions. Integration projects can play a helpful role in helping to document measures needed to evaluate projects. ASWM has developed a supporting resource on "Capturing the Value of Integration: Considering Benefit-Cost Measures When Making Decisions about Integration Activities" that is can be found in Appendix F.

Additional Considerations:

1) Big Projects take Big Thinking and Planning

In order to accomplish integration at the state level, many of these activities required some form of new legislation and/or multi-agency agreements. They required the formalization of a vision that was developed by a few staff members, then taken to leadership who supported the effort in ways that allowed for collaboration building. The level of formalization increases as the level of integration also increases. Simple coordination and brainstorming among agencies to find common ground required less effort, while bringing two permitting programs together into one or developing a single monitoring program from many took extensive planning and formalization. Consequently, the more ambitious the integration effort, the more investments in structures, agreements and resources were required.

2) Wetlands are Often Not in the Driver's Seat for Integration Initiatives

While wetlands played a role in each of these projects, in some cases critical ones, they were often not the driver for collaboration. Only two state program integration case studies were led by wetland program staff (Vermont and Missouri). Wetland protection or restoration tended to be involved more on the fringe. This is often true for watershed projects as well, where wetlands are a means to an end, a restoration tool to achieve larger goals, but not the driver. Wetlands, consequently, tend to be included to add value to other projects or initiatives. The take-away from this finding is that while wetland staff may not always be in the driver's seat or wetlands at the forefront of integration efforts, there are important ways that wetlands can fit into other collaborative initiatives. Effort should be taken to examine places where wetlands can be added in and promote areas where wetland activities can enhance other projects, especially consider tying-in with ongoing watershed planning and stormwater management activities.

3) Watershed Projects are Often Designed to Address High Stakes Issues

While the general focus on integration projects discussed in this white paper is on natural resource management that includes wetlands, analysis of these case studies indicates that many of the issues that brought the partners together, the needs that they are designed to address, are highly social and complex in nature. Understanding the social component of integration projects is important in order to ensure that time is included to address these elements of the project and professional services, such as facilitators, can be included in project design to assist managers who may not have expertise in this type of work.

4) Visionary Leaders are Often at the Heart of Collaboration – Plan for Transition

In order to ensure that integration is sustainable over time, transition planning is key. Highly successful collaboration often begins with the leadership of one or several visionary leaders. Without this vision and drive, and perhaps the relationships that the leader brings to the table, collaboration would not have been initiated or as successful. One of the hardest elements of long-term collaboration is maintaining momentum over time to get to the finish line. Planning and documentation should take place to create a self-sustaining organizational structure and grooming of new leaders should be taken into consideration if transitions may take place.

Other Resources

ASWM Publications:

- Healy, M., and Secchi, S. (2016). *A Comparative Analysis of Ecosystem Service Valuation Decision Support Tools for Wetland Restoration*. Association of State Wetland Managers, Windham, Maine.
- Stelk, M.J. & Christie, J. (2014). *Ecosystem Service Valuation for Wetland Restoration: What It Is, How To Do It, and Best Practice Recommendations*. Association of State Wetland Managers, Windham, Maine.
- Stelk, M.J., Christie, J., Weber, R., Lewis, R.R.III, Zedler, J., Micacchion, M., ... Merritt, J. (2017). *Wetland Restoration: Contemporary Issues and Lessons Learned*. Association of State Wetland Managers, Windham, Maine.
- Zollitsch, B., and Christie, J. (2016). *Status and Trends Report on State Wetland Programs in the United States*. Association of State Wetland Managers, Windham, Maine.

External Publications and Resources:

- Identifying and Protecting Healthy Watersheds: Concepts. Assessments and Management Approaches (EPA, 2012)
- Healthy Watersheds Initiative: National Framework and Action Plan (EPA, 2011)
- Healthy Watersheds Integrated Assessments Workshop: Advancing the State of the Science on Integrated Healthy Watershed Assessments and Considering the Role of Green Infrastructure in Maintaining Watershed Health and Resilience (EPA, 2011)
- Healthy Watershed Integrated Assessments Workshop Synthesis (EPA, 2011)
- EPA Website on Sustainable Water Infrastructure
- Handbook for Developing Watershed Plans to Restore and Protect Our Waters – March 2008
- The Ecosystem-Based Management (EBM) Tools Network
- Center for Watershed Protection Releases Urban Stormwater Retrofit Practices Manual (Center for Watershed Protection, 2016)
- EPA Website on Healthy Watersheds: Protecting Aquatic Systems through Landscape Approaches
- EPA Website on Incorporating Wetland Restoration and Protection in Planning Documents
- 2015 EO Progress Report Update on FLC's Strategy for Protecting and Restoring the Chesapeake Bay Watershed (Federal Leadership Committee for the Chesapeake Bay, 2016)
- Wetlands and Watershed Protection Toolkit for New York
- EPA Website Resources on Nutrient Pollution

Appendices

Appendix A: List of HWHW Webinars

Appendix B: List of HWHW Workgroup Members

Appendix C: State Program Integration Case Studies

Appendix D: Watershed Project Highlights

Appendix E: Watershed Project Datasheets

Appendix F: Considerations for Measures of Integration Value

Appendix A: List of HWHW Webinars

July 10, 2018 **View Recording Here**
Floodplain Policies for Flood Survivors - A Conversation – Sarah Wilkins, Thriving Earth Exchange, American Geophysical Union; Virginia Wasserberg, Stop the Flooding NOW!, Virginia Beach, VA; Bob Jennings, Stop the Flooding Now, Virginia Beach, VA; Lori Burns, RainReady Chatham, Chicago, IL; Gabriella Velardi-Ward, Coalition for Wetlands and Forests, Staten Island, NY; and Ed Browne, Residents Against Flooding, Houston, TX

May 15, 2018 **View Recording Here**
Wetlands by Design: A watershed approach for Wisconsin – Tom Bernthal, Wisconsin Department of Natural Resources and Nick Miller, The Nature Conservancy

January 9, 2018 **View Recording Here**
Reaching Across the Border to Improve Water Supplies for People and Nature: The United States, Mexico, and the Colorado River – Jennifer Pitt, Audubon

December 19, 2017 **View Recording Here**
Towards Resilient and Sustainable Floodplains – Larry Roth, Arcadis

October 24, 2017 **View Recording Here**
The Iowa Watershed Approach: A New Paradigm for Flood Resilience – Allen Bonini, Iowa Department of Natural Resources; Dr. Craig Just, University of Iowa; Melissa Miller, Iowa Water Center; Breanna Shea, Iowa Flood Center, University of Iowa; Jake Hansen, Iowa Department of Agriculture and Land Stewardship- Division of Soil Conservation and Water Quality; and Jessica Turba, Disaster Recovery Operations Bureau of Iowa Homeland Security and Emergency Management

July 25, 2017 **View Recording Here**
Integrated Stream and Wetland Restoration: A watershed approach to improved water quality on the landscape – Dr. Curtis Richardson, Duke University Wetland Center

February 21, 2017 **View Recording Here**
The Value of Nature: Practical Applications for Managers – Elizabeth Schuster, Environmental Economist, The Nature Conservancy

Appendix B: List of HWHW Work Group Members

Federal

EPA	Rebecca Dils EPA Wetland State and Local Liaison Environmental Protection Agency Office of Wetlands, Oceans and Watersheds
	Lisa Hair PE Senior Environmental Engineer Environmental Protection Agency Office of Water
	Marissa Mazzotta Environmental Economist Environmental Protection Agency Atlantic Ecology Division
FWS	Jason Miller Biologist Fish and Wildlife Service Chesapeake Bay Field Office

State

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Appendix C: State Program Integration Case Studies

- **Indiana**: Improving Program Efficiency for Wetland and Stormwater Permitting through Joint Management in Indiana
- **Minnesota**: "One Watershed, One Plan": An Initiative to Leverage data to Get Better Results for Clean Water in Minnesota
- **Minnesota:** Integration of Groundwater Appropriations Permitting and Surface Water Permits, including Wetlands
- **Missouri**: Cross-Program Wetland Coordination in Missouri
- **Nebraska**: Incorporating Wetlands into reservoir Rehabilitation Projects for Fisheries and Other Benefits in Nebraska
- **New Mexico**: Integrating Wetlands into Nonpoint Source Plans and 319 Projects
- **Vermont**: Integration of Vermont Watershed Management Division's Water Quality Monitoring Programs: Combining Wetland, Lake and River Program Monitoring
- **Vermont**: Wetland Restoration and TMDLs in Vermont's Lake Champlain basin

ASWM State Wetland Program Integration Case Study: Indiana

Improving Program Efficiency for Wetland and Stormwater Permitting through Joint Management in Indiana

State Wetland Program Information

This case study[1] explores the integration efforts undertaken by the Indiana Department of Environmental Management (IDEM). Established in 1986, IDEM's mission is "to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial and government activities vital to a prosperous economy."[2]

With an annual operating budget of approximately $1 million IDEMS Wetlands Program is managed by a Section Chief overseeing a team of twenty-one full-time staff. Program staff include seven Environmental Specialists, seven Stormwater Project Managers, and seven project managers who guide permit applicants though the pre-application, permitting, monitoring and enforcement process.

[1] Project Case Study Criteria: The Association of State Wetland Managers (ASWM) conducted interviews with representatives from state wetland programs actively integrating with one or more additional resource management programs operating within their state. Criteria for case study inclusion required eligible programs to demonstrate direct or indirect impacts of integration on watershed-level planning, implementation and/or outcomes documented using formal or informal performance measures. Further consideration was given to integrated programs with the ability to provide cost-benefit insights.

[2] Header. (n.d.). Retrieved from https://www.in.gov/idem/cleanwater/2330.htm

Type of Integration Effort

IDEM's integrated Wetlands Program administers Indiana's wetland and stormwater permitting, monitoring and enforcement activity promoting efficiency and continuity in the management of these important resources and processes.

Scale of Integration Effort

The Wetland Program has statewide jurisdiction over all permitting, monitoring and enforcement related to wetlands and stormwater. This includes everything from construction through 401 certifications. Some other types of permitting are delegate to Indiana's Soil and Water Conservation Districts (SWCD) including Municipal Separated Storm Sewer System (MS4s).

Project Leadership

The Wetlands Program is operated by IDEM. Water Director Martha Clark Mettler spearheaded the effort to integrate the state's wetland and stormwater management along with support from the organization's senior management. Current operational leadership includes Branch Chief Brian Wolff, Section Chief Randy Braun, and Sr. Wetland Specialist Jay Turner.

Integration Goals

By integrating the Wetland and Stormwater Programs IDEM aims to increase program efficiency, streamline compliance measures, and better support the regulated community. Through collaboration and cross training integration increases the program's capacity to process permit applications, monitor and enforce regulations, and respond to permittee questions and complaints in a timely manner.

Integration Process Timeline

While Indiana's Wetland Program has always been under the purview of IDEM, the state's stormwater management was original overseen by the of the Department of Natural Resources (DNR). Prior to integration, these programs were collectively processing approximately 2,500 permits per year, each operating with a staff of seven to manage all permitting, monitoring and enforcement efforts. In 2010 Water Director Martha Clark Mettler, along with the support of IDEM and DNR senior management, recognized that integrating these programs would increase efficiency and effectiveness.

Following an initial planning period, the first phase of integration was launched in 2012, transitioning both programs into one section at IDEM. Structural changes were made to the reporting hierarchy and the physical office layout. Merging of the programs also saw internal procedures and permitting processes strategically combined where applicable to streamline resource management and reduce procedural redundancies. All communications, inspections, and monitoring reports were collected through a new online portal and managed in a single database increasing access to information and expediting workflow. Staff received cross training, allowing them to support the overarching work of the program while continuing to operate as experts in their individual specialties.

The most recent integration efforts have focused on the increased use of technology to enhance the program's work. IDEM has invested $400,000 in the development of a new database to manage construction permitting and is moving to a new electronic permitting system. If this new system is successful a similar digital process will be established for wetlands permitting as well. As applicants must currently access separate wetland and stormwater permitting documents this integrated digital system, which will utilize SmartForms has the potential to streamline the permittee experience and expedite the permitting process. In the long run, the agency hopes to create a single digital system that stores all of this information, as well as a searchable database of issued permits and violations by applicant name.

Resource Investment

IDEM's move towards an integrated permitting program has been an organic, gradual process with little capital cost involved beyond the initial expense of relocating people, extensive filing systems (containing hard copy permits, NOIs and other documents) and equipment. Much of the staff cross-training was conducted in-house, drawing upon the "train the trainer" method. However, some specialists did receive job-specific training depending on their role and expertise. Additional marginal costs included updating program documents and website to reflect the new section name. The most significant resource investment has gone towards technology improvements, including $400,000 to develop an electronic database and online portal for all construction-based permitting. If this system is successful IDEM will pursue development of a similar system for wetland permitting. A final, though critical element was restructuring all communications to integrate under the new section.

How Success Has Been Measured

IDEM's Wetland Program has identified the following output and outcome metrics to gauge their success:

Integration Outputs:

- Development of a new shared permitting process
- Agency staff from both permitting programs relocated into one physical locations
- Development of a new joint permitting entity under one section
- Development of shared inspection tasks
- Regular cross-training activities

Integration Outcomes:

- **Faster, Unified Permit Processing:** Prior to integration stormwater and wetland permitting were two separate processes operated by two different organizations. With most applicants requiring both permits the old process could take nearly a month to complete. Following integration applicants navigate a single, streamlined and updated process which now takes an average of twelve days to complete a combined permitting request. This is helping work towards the agency's new directive to reduce processing time down to seven days.
- **Increased Inspection & Compliance:** An important aspect of integration was the cross-training of program staff. This doubles the number of inspectors, allowing for more frequent and thorough inspections. With increased "eyes on the road" both permitting staff groups have been able to increase their capacity and use their time more efficiently.

- **Increased Compliance:** More frequent and thorough inspections has resulted in violations coming into compliance faster.
- **Collaborative Problem-Solving:** The agency staff now work jointly to address issues like violations where an individual destroyed a headwater stream, conducted activities that contributed to sediment pollution, or did not apply for a permit.
- **More Consistency:** Previously with two separate permitting processes applicants would complain that they were receiving, sometimes differing, information from representatives at each agency. After integration all project managers are aligned around the same goals and unified by a single process allowing them to respond more effectively to applications, violations and other arising issues. Additionally, a more cohesive unit reduces the opportunity for applicants to play permitting program staff against each other.
- **Fewer Complaints:** Since integration agency staff have reduced the response time for addressing complaints from a couple of months to just a few weeks. Everyone has access to the complaint database allowing them to document issues as they arise, request specialist assistance if needed, and monitor progress towards resolution.
- **Applicant Satisfaction:** Although satisfaction surveys have not been sent to permittees at this time, qualitative and anecdotal reports indicate applicants are pleased with the new system.
- **Consultant Satisfaction:** Consultants have also provided the agency with positive feedback on the new service. They appreciate the simplicity of dealing with a single agency, for example receiving one unified list of violations to take to the client.

Impact on Watershed-level Planning, Implementation or Outcomes

While the IDEM's integrated Wetlands program has a statewide purview, it does not incorporate a watershed perspective in its work. While the IDEM has seen many advantageous outcomes from its integration effort, it is important to note that integration and watershed level planning are not necessarily synonymous.

Cost Benefit Insights

While a formal cost-benefit analysis has not been conducted for IDEM's program integration, an informal assessment identified several opportunities for potential cost savings. First, while there hasn't been a reduction of staff or equipment required, there is now a single manager responsible for the merged programs. Secondly, intentional cross-training of staff to conduct both wetland and stormwater inspections has increased the program's ability to quickly identify violations. This expanded inspection capacity, combined with more efficient internal processes has resulted in violations coming into compliance faster. Furthermore, conducting joint inhouse trainings drawing upon the diverse expertise of the program's staff has likely reduced training expenses.

Other Impacts

Navigating wetland and stormwater regulations can present challenges for the regulated community throughout the permitting, monitoring and enforcement process. Prior to integration when an issue arose, or a permittee had a question they would potentially have to go through processes within both programs in order to reach a final resolution. With the current integrated system issues regarding wetland and

stormwater regulations can be handled by a single staff person reducing response times by eliminating redundancies and streamlining processes.

Information about Policy-related Issues

No legislative changes were required to implement this integration effort. However, the Commissioner's approval was an important factor in moving forward as was the buy-in of department staff and leadership at both the IDEM and DNR.

Challenges & Lessons Learned

As a top-down directive, staff buy-in was an essential component to the success of this integration effort. Initial staff concerns included changes to individual responsibilities and performance metrics, as well as a fear that their positions would be eliminated altogether. Clear communication from senior leadership helped to support the staff through this transition. Additionally, it was conveyed to staff from the start that their positions would remain fundamentally the same and staff would continue to focus on their specialty. The transition was framed around the goal of being able to provide better protection of human health and the environment, something most agency personnel agreed about. There were concerns from some staff that their work was going to be spread out to other people and that rules would change. The transition was easier for newer staff than those who had been in their positions for longer periods of time.

Next Steps

As initial integration of staff and internal processes is completed, the focus has shifted towards increasing the use of technology to support the staff and the regulated community. There have been many technological developments in recent years that can enhance the program's efficiency and effectiveness. For example, IDEM's investment in developing integrated electronic databases for each of the programs and creating a "one stop" online portal for all permitting activity will help to streamline the permittee experience and expedite the permitting process. The online portal will also incorporate electronic SmartForms that prompt you for more information based on your answers, allow monitoring reports to be digitally submitted online, and sync with integrated databases for efficient and accurate data entry and reporting.

IDEM is also in the process of implementing an integrated inspection priority system that incorporates topographical maps, soil types, rain reports, and other essential information. This digital system will identify locations with the highest probability of issues, creating a score to prioritize inspection sites based on construction site size and 303(d) impaired waters data. It will also generate a map with the most efficient route for conducting multiple inspections in a single outing. IDEM anticipates this new program will be ready for staff to use by April 1st, 2019.

Additionally, the Wetlands program is interested in increasing staff training around green infrastructure and identifying opportunities to incorporate this information into their regulatory work in partnership with planners.

Transferability

The integration effort undertaken by IDEM is highly transferable to wetland and stormwater programs in states looking to streamline their permitting, monitoring and enforcement efforts and improve support for the regulated community. An important component of IDEM's success was the parallel strength of both their Wetland and Stormwater programs prior to integration in terms of experience, expertise and management. States hoping to replicate Indiana's program should evaluate each department thoroughly before initiating integration in order to identify potential issues.

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Additional Resources

- Indiana Department of Environmental Management
- IDEM will have new online resources available in April 2019

ASWM State Wetland Program Integration Case Study: Minnesota

"One Watershed, One Plan": An Initiative to Leverage Data to Get Better Results for Clean Water in Minnesota

State Wetland Program Information

This case study[1] examines the integration efforts of the Minnesota Board of Water and Soil Resources (BWSR) through the "One Watershed, One Plan" (One Watershed, One Plan) program.

Established in 1987 BWSR is the state soil and water conservation agency for "90 soil and water conservation districts, 46 watershed districts, 23 metropolitan watershed management organizations, and 80 county water managers. It administers programs that prevent sediment and nutrients from entering Minnesota's lakes, rivers, and streams; enhance fish and wildlife habitat; and protect wetlands. The 20-member board consists of representatives of local and state government agencies and citizens. Core functions include implementing the state's soil and water conservation policy, comprehensive local water management, and the Wetland Conservation Act as it relates to the 41.7 million acres of private land in Minnesota."[2] The BWSR's 2018-2019 biennium budget received most of its revenue from the Clean Water

[1] Project Case Study Criteria: The Association of State Wetland Managers (ASWM) conducted interviews with representatives from state wetland programs actively integrating with one or more additional resource management programs operating within their state. Criteria for case study inclusion required eligible programs to demonstrate direct or indirect impacts of integration on watershed-level planning, implementation and/or outcomes documented using formal or informal performance measures. Further consideration was given to integrated programs with the ability to provide cost-benefit insights.

[2] BWSR - Wetland Regulation in Minnesota Overview, Minnesota Board of Water and Soil Resources, www.bwsr.state.mn.us/aboutbwsr/index.html.

Fund. Ninety percent of this budget will be used to fund grants to local government units and ten percent will cover operating costs.[3]

The One Watershed, One Plan program was initiated in 2014 with the goal of aligning local water management along major watershed boundaries. Currently the program is administered by one full time coordinator. Additionally, twenty-three regional field staff work within one or more watersheds, to support watershed plans through the development and approval process. The One Watershed, One Plan program brings together the state's two wetland agencies - DNR (public state permitting law – lakes, streams, rivers and large wetlands) and BWSR, as well as local governments working to address wetlands through the wetland conservation act. Between 2014 and 2019, the state legislature has appropriated 9.1 million dollars to implement the One Watershed, One Plan program.

Type of Integration Effort

One Watershed, One Plan supports partnerships of local governments in developing prioritized, targeted, and measurable implementation plans. Key principles include planning at the major watershed scale and aligning local plans with state strategies. Plans created through the One Watershed, One Plan program are called "comprehensive watershed management plans"[4] and encompass surface water quality and quantity, groundwater, drinking water, habitat, recreation and other issues covering both rural and urban areas. The program offers many guides and resources to help facilitate the development of these plans and ensure all required components are included as outline in the statue.

Scale of Integration Effort

One Watershed, One Plan is a statewide program providing planning grants, policies and guidance, and planning support for local government partnerships[5]. The grants are intended to incentivize local municipalities to collaborate in the development of a comprehensive plan which identifies and prioritizes resources and issues on a watershed level. Soil and water conservation districts (SWCDs), counties, and watershed districts are required to participate in the development of comprehensive watershed management plans. Participation is voluntary for local governments in the seven-county metropolitan area because those watershed management organizations are already subject to more robust requirements[6]. Additionally, there are some exemptions for required participants when the watershed covers a small percentage of the land area in their jurisdiction.

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[3] "BWSR Budget." BWSR - Wetland Regulation in Minnesota Overview, Minnesota Board of Water and Soil Resources, www.bwsr.state.mn.us/budget/index.html.

[4] What Is One Watershed, One Plan? - Bwsr.state.mn.us. www.bwsr.state.mn.us/planning/One Watershed, One Plan/One Watershed, One Plan_Fact_Sheet_2018.pdf.

[5] The Comprehensive Watershed Management Plan is intended to replace the existing county water plans, watershed district plans, and Soil and Water Conservation District comprehensive plans for the entire planning boundary while leveraging and incorporating WRAPS, TMDLs, and other valuable data and information.

[6] Ibid.

Integration Goal(s)

The BWSR mission is to improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private landowners. The One Watershed, One Plan program supports this overarching goal by working to establish effective and efficient management practices at the watershed level through integrated partnerships and strategic planning. Because watershed boundaries do not align with political boundaries, watershed level management, which is the most effective way to improve and protect Minnesota's water, needs to happen across multiple jurisdictions. By brining vested parties together from across the watershed One Watershed, One Plan works to align local governments, state and federal agencies and the public towards a shared understanding of issues, priorities, and goals. This collaboration between upstream and downstream neighbors allows consolidated resources and expertise to target the most important issues at the watershed level.

The Minnesota legislature set a goal for BWSR to transition the entire state to watershed level management within a 10-year period, replacing existing county and district plans with comprehensive watershed management plans. The program aims to create continuity by setting standards for plan content that "establish a systematic, watershed-wide, science-based approach to watershed management; driven by the participating local governments."[7] Plans focus on "prioritized, targeted, and measurable implementation of restoration and protection activities with clear implementation timelines, milestones, and cost estimates that will address the largest threats and provide the greatest environmental benefit unique to each watershed."[8] Finally, the One Watershed, One Plan program will also increase planning expertise across the state by offering comprehensive resources to support development of these plans.

Integration Process Timeline

The Minnesota Board of Water and Soil Resources was created in 1987 when the Legislature combined the Soil and Water Conservation Board with two other organizations with local government and natural resource ties: the Water Resources Board (established in 1955) and the Southern Minnesota Rivers Basin Council (established in 1971).[9]

Three preliminary events helped to lay the groundwork for Minnesota's transition to watershed level management of its aquatic resources. In 2006 the Minnesota Pollution Control Agency (MPCA) began to shift towards watershed-based assessment. Concurrently, the Clean Water Legacy Act was passed, which set up a policy and funding framework for the shift to watershed-based management. A few years later in 2008 a constitutional amendment was passed increasing "the state sales tax three-eighths of one percent… in order to provide revenue to protect the natural resources of the state and to preserve Minnesota's arts and cultural heritage."[10]

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[7] "One Watershed, One Plan Guiding Principles" BWSR - http://www.bwsr.state.mn.us/planning/One Watershed, One Plan/One Watershed, One Plan_Guiding_Principles.pdf

[8] Ibid.

[9] "About the Board of Water and Soil Resources" BWSR, www.bwsr.state.mn.us/aboutbwsr/index.html.

[10] Minnesota Sales Tax Increase, Amendment 1 (2008). (n.d.). Retrieved from https://ballotpedia.org/Minnesota_Sales_Tax_Increase,_Amendment_1_(2008)

"One Watershed, One Plan (One Watershed, One Plan) started as a policy recommendation [in 2011] from the Local Government Water Roundtable (LGWR) and was followed by legislation in 2012 that authorizes BWSR to adopt methods to allow comprehensive plans, local water management plans, or watershed management plans to serve as substitutes for one another; or to be replaced by a Comprehensive Watershed Management Plan."[11]

In 2014 BWSR "launched the One Watershed, One Plan pilot program, allocating up to $900,000 in Clean Water Fund grants to fund five pilot projects to address water quality on a watershed basis."[12] The five pilot areas were Lake Superior North watershed, North Fork Crow River watershed, Red Lake River watershed, Root River watershed, and Yellow Medicine River watershed.

"Additional legislation was passed in 2015 providing the purposes for and better definition of Comprehensive Watershed Management Plans. The 2015 legislation also requires BWSR to adopt a transition plan for moving to Comprehensive Watershed Management Plans, with a legislative goal for statewide implementation of One Watershed, One Plan by 2025".[13]

In December the first two pilot plans completed through BWSR's One Watershed, One Plan program were approved: the Root River Comprehensive Watershed Management Plan and the Yellow Medicine River Comprehensive Watershed Management Plan. "The plans each identify priority projects and programs for the designated watershed over the next ten years. For the Root River plan, those priorities include drinking water, stream and river health, and more. The Yellow Medicine plan has priorities that include minimizing flooding, improving water quality through sediment and nutrient reductions, and protecting groundwater. As part of the planning process, local partners commit to working together and will check-in on a regular basis to track progress and periodically update the plan."[14]

Following a successful two-year pilot period BWSR began to ramp up its rollout of One Watershed, One Plan in 2016 with the board approving the program's plan content requirements and operating procedures. In October of that year the board allocated up to $1,700,000 in Clean Water Fund grants to fund seven planning projects to address water quality on a watershed basis."[15] The seven new planning areas were: Cannon River watershed, Cedar River watershed, Lake of the Woods watershed, Leech Lake River watershed, Missouri River Basin watershed, Pomme de Terre River watershed, and Thief River watershed. On June 28, 2017 the board allocated up to an additional "$1,500,000 in Clean Water Fund grants to fund

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[11] "One Watershed, One Plan FAQs" BWSR - Wetland Regulation in Minnesota Overview, Minnesota Board of Water and Soil Resources, http://www.bwsr.state.mn.us/planning/One Watershed, One Plan/One Watershed, One Plan_FAQs_General.pdf

[12] "BWSR Launches Statewide Water Initiative" - BWSR, 2014, http://www.bwsr.state.mn.us/news/newsreleases/06-26-14_One_Watershed_Release.pdf

[13] "One Watershed, One Plan FAQs" BWSR - Wetland Regulation in Minnesota Overview, Minnesota Board of Water and Soil Resources, http://www.bwsr.state.mn.us/planning/One Watershed, One Plan/One Watershed, One Plan_FAQs_General.pdf

[14] "Minnesota Approves First-Ever Comprehensive Watershed Management Plans for Yellow Medicine and Root Rivers" BWSR – 2016 http://www.bwsr.state.mn.us/news/newsreleases/12-22-16_One Watershed, One Plan_release.pdf

[15] "Innovative approach to water management takes next step" – BWSR, 2016. http://www.bwsr.state.mn.us/news/newsreleases/10-06-16_One Watershed, One Plan_release.pdf

six more planning projects."[16] The six planning areas were: Buffalo-Red River watershed, Lower St. Croix watershed, Mustinka/Bois de Sioux watershed, Pine River watershed, Sauk River watershed, and Watonwan River watershed. In 2018 the board approved up to $2.1 million for eight additional planning boundaries, brining the total number of boundaries participating in the program to 27 (of 60) planning boundaries.

Project Leadership

As watershed management plans are developed locally, each plan has its own policy committee and advisory committee consisting of staff from local government and state water agencies along with representatives from other stakeholder groups. Depending on the local landscape this can include agricultural producers, county highway, planning, and zoning staff, drainage authorities, lake association members, recreational interests, local businesses, cites and tribal representatives and federal partners such as Natural Resources Conservation Service (NRCS), United States Forest Service (USFS), and the United States Fish and Wildlife Service (USFWS).

Resource Investment

BWSR allocates resources to fund the One Watershed, One Plan costs along with the local planning grants. Local government units can use approved grant funding to hire consultants to draft plans, conduct modeling and help facilitate the process. Costs not covered by planning grants must be funded at the local level. The program is intended to support locally developed and locally owned plans. Local government units are not required to raise matching funding in order to utilize these planning grants. BWSR recognizes the substantial amount of time and effort required by local partners, which is often not paid for by grants, to successfully develop a watershed level management plan an in-kind investment. This approach recognizes the value of local participation and coordination which often requires attending ongoing meetings, developing shared priorities and goals, overseeing ongoing information gathering and analysis, and developing documents and processes.

Impact on Watershed-level Planning, Implementation or Outcomes

How Success Has Been Measured

While Minnesota's One Watershed, One Plan program is still new, the following metrics have been identified to gauge their success.

Integration Outputs:

- Since the launch of the One Watershed, One Plan program in 2014, hundreds of watershed planning meetings have been held across the state engaging stakeholders in the watershed planning process.
- To date there are twenty-seven watersheds participating in the program
- Six comprehensive watershed plans have been completed and approved by BWSR.

[16] "Local Governments Join Forces to Plan for Water Management" BWSR – 2017
http://www.bwsr.state.mn.us/news/newsreleases/2017-07-11-Release-Water-Mgmt.pdf

- Plans include specific outcomes (e.g. Root River plan will reduce sediment by 15k over ten years. Which represents 21% of the needed progress).

Integration Outcomes:

- The One Watershed, One Plan program has led to a paradigm shift in how local governments think about managing their water resources.
- The project has increased collaboration among the partners.
- The project has led to more strategic allocation of funds.
- Project plans are able to tackle more complex issues.

Creating a Paradigm Shift

One example of this can be seen in the Lake Superior North watershed. This watershed, which encompasses two counties, was part of the initial pilot phase of One Watershed, One Plan. After completing the planning process one implemented change was to move to a single stormwater management system located in one city. Other examples include Red Lake Watershed and Cannon Watershed.

Cost Benefit Insights

No information provided.

Information about Policy Related Issues

Once a comprehensive watershed management plan is adopted, local planners no longer need to have a local (county or watershed district) plan. In Minnesota, this arrangement meets requirements in the state statute.

Challenges & Lessons Learned

One of the biggest challenges the BWSR faced in launching the One Watershed, One Plan program was getting local jurisdictions to work together and think at the watershed level after decades of managing at the local level. This was further complicated by initial confusion of the program's intentions, with many under the misconception that One Watershed, One Plan would add another layer of government. Considerable effort was required to communicate the program's goals. Working with the statewide associations of local governments was key to attaining buy-in from individual elected officials at the local level.

Additionally, the internal capacity of watershed partners to execute planning and implementation of watershed level projects vary greatly depending on the expertise and skills of the local staff. Setting measurable goals to monitor environmental improvements also presents a challenge.

Finally, many metrics that can be used to evaluate an effort to improve water quality are also affected by a range of factors beyond the control of watershed management, such as land uses and climate change. Understanding the limitations of attributing changes to a specific project should be encouraged, while still pursuing the activities.

Next Steps

BSWR is dedicated to the ongoing implementation and growth of the One Watershed, One Plan program as it continues to move towards the goal of statewide watershed planning by 2025. The One Watershed,

One Plan program is designed to continue to support the evaluation of plans and updates to plans as needed at the end of this period. The program sets an expectation that local governments will evaluate every five years whether updates to plans are needed. In addition to increased participation and the expansion of watershed partnerships, BWSR hopes to continue to support local staff across the state to increase their skills and expertise. This increased internal capacity will help watershed partners become less reliant on consultants in the planning and implementation of watershed management plans resulting in cost-savings.

Transferability

Two relatively unique circumstances contributed to the development of the One Watershed, One Plan program in Minnesota and shaped its implementation. First is the 2008 constitutional amendment increasing the sales tax and designating the funds to protect natural resources. The second is the state's long history of water management by local governments. Without either of these factors the One Watershed, One Plan program may not have evolved into the current model. However, the formalized documentation of BWSR's work to launch the program along with the many resources they have created to help facilitate the development of watershed management plans can offer guidance to other states interested in watershed level management. With some necessary adaptations this is a highly replicable integration program.

Fortunately, the One Watershed, One Plan Program has developed a fifty-four page guidebook that breaks down each element of plan writing – prioritizing, target implementation program, outreach, etc. This documentation serves as a valuable resource for those interested in learning about or adapting the approach in other contexts.

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Additional Resources

- Wetlands Regulation in Minnesota Summary (06/2016)
- BWSR One Watershed, One Plan
    - One Watershed, One Plan Guidebook
    - Plan Content Requirements (March 28, 2018)
    - Operating Procedures (March 28, 2018)
    - Guidance for Committees and Getting Ready to Plan (March 28, 2018)
- MN DNR Water Permits

ASWM State Wetland Program Integration Case Study: Minnesota

Integration of Groundwater Appropriations Permitting and Surface Water Permits, including Wetlands

Photo Credit: Minnesota DNR

State Wetland Program Information

This case study[1] explores the integration efforts undertaken by the Minnesota Department of Natural Resources Ecological and Water Resources Division. Four sections of the DNR with different units, including the Wetland Program are involved in the project. Other partners include Minnesota Bureau of Soil and Water Resources (BWSR) and local governments, both having regulatory roles with wetlands management within the state. The state has two wetland regulatory programs in the state: 1) DNR's public state permitting law that covers lakes, streams, rivers and large wetlands and 2) the Wetland Conservation Act, which is implemented by BWSR and local government.

[1] Project Case Study Criteria: The Association of State Wetland Managers (ASWM) conducted interviews with representatives from state wetland programs actively integrating with one or more additional resource management programs operating within their state. Criteria for case study inclusion required eligible programs to demonstrate direct or indirect impacts of integration on watershed-level planning, implementation and/or outcomes documented using formal or informal performance measures. Further consideration was given to integrated programs with the ability to provide cost-benefit insights.

Type of Integration Effort[2]

This project brings together wetland management, state groundwater appropriations and surface water permitting. The effort is designed to better understand and work to integrate the way that groundwater and surface water permitting programs work together when groundwater appropriations may affect wetlands.

Minnesota has plentiful water supplies. Even so, there are several places around the state where demand for groundwater may be greater than supply. These places tend to be in the drier southwestern areas of the state, in the heavily irrigated central sands, and in the Twin Cities Metropolitan Area. While the state's water management policies, statutes, and rules are strong and conceptually sound, they could be improved.

There is a strong scientific basis for maintaining the natural dynamic patterns of surface water bodies by establishing protected flows for individual streams, protection elevations for individual basins, and target hydrographs for wetlands. Science indicates that Minnesota's streams, basins, and wetlands are vulnerable to undesirable ecosystem change during conditions of low flow, low elevation, or deviation from the target hydrograph, respectively. These conditions will be made worse during regular, periodically occurring severe drought.

The DNR intends to set protected flows, protection elevations, and target hydrographs for water bodies in places where demand for water may be exceeding sustainable supplies. The DNR is currently establishing groundwater management areas in parts of the state experiencing high demand for groundwater. The DNR will set protected flows, protection elevations, and target hydrographs for some surface waters within these groundwater management areas, and potentially in other areas of the state, as described above, in order to manage water appropriations. The project partners have made recommendations to the legislature for statute changes to help support the integrated work.

Specific recommendations to the legislature included:

1) Incorporation of a new set of mutually agreed upon set of definitions into Chapter 103G[3],
2) A "threshold" is the point at which negative impacts occur. The partners recommend specific methods for determining thresholds for streams, lakes, and wetlands.
3) Combining many of the standards in two sections (Section 103G.285 establishes limits for withdrawals from surface water bodies (watercourses and basins) and Section 103G.287 establishes standards for groundwater appropriations) into a single "Water Appropriations" section that would recognize the hydrologically connected and interdependent nature of surface and groundwater resources.
4) Establishment of a public process in locations were protected flows and/or protection elevations need to be established, involving a range of representative water users to better understand the multiple resource values and tradeoffs that must be considered in setting these limits.

[2] This section includes summarized text from the Conclusions section of the following report: https://files.dnr.state.mn.us/waters/gwmp/thresholds/gw-thresholds-project_report.pdf

[3] Ibid.

Scale of Integration Effort

Integration has been undertaken at the statewide level.

Integration Goals

The two primary goals of this integration effort are to:

1) Ensure that wetlands are protected per state law
2) Clarify the roles of groundwater permitting and surface water permitting programs when groundwater appropriations may be affecting wetlands.

Integration Process Timeline

For many years, discussions have taken place in the field around individual permits. Informal discussion between the DNR and BWSR have identified needs around coordinating permitting. This effort informally began in 2015, when the state began working on development of a long-term water quality monitoring program to identify hydrographs. These hydrographs will be used by the state to inform permitting. The state is working to identify "normal" hydrographs for different kinds of wetlands. A report on this issue was published in 2016. Efforts continue to be informal but have led to informal agreements and the submission of a report to the Legislature. The legislature has recently passed a new law allowing the DNR to temporary drawdown of calcareous fens, which could have a negative outcome. The partners are jointly looking at how to implement that new law with the least impact to wetlands.

Project Leadership

Minnesota DNR has taken the leadership on this initiative, with a variety of DNR staff involved in different ways. The DNR established four technical work groups focused on stream systems, lake systems, wetland systems, and policy and procedures. The technical teams consisted primarily of staff from multiple DNR divisions, but also included experts from the University of Minnesota, other state and federal agencies, and the private sector. A list of all project participants is listed in Appendix D of the report. Technical teams were developed to address specific issues.

Resource Investment

The project has been funded by a combination of government, nonprofit, and private funding, staffing and in-kind supports. These have included both up-front expenses and long-term support.

Impact on Watershed-level Planning, Implementation or Outcomes: How Success Has Been Measured

Outputs:

- The partners, including the interagency units have come to agreement on key definitions
- A series of stakeholder meetings
- A report outlining needs and recommendations

- Findings specific to wetlands were developed for the final project[4]
- The partners were able to compile and make recommendations to the legislature for changes
- Technical teams were created to explore details related to streams, lakes and wetlands.

Outcomes:

- The creation of strategies (listed in the plan) designed to:
    - Improve information about our groundwater resources
    - Reinforce partnerships to provide support for sustainable groundwater use
    - Improve compliance with existing groundwater regulations
    - Assure permits for large water appropriations provide sustainable supplies of groundwater
    - Concentrate actions in areas of high groundwater use and/or limited groundwater supply
- Consideration of specific technical issues related to streams, lakes and wetlands by teams of technical experts to inform decision making.
- Consideration of new definitions by the legislature in the regulation of groundwater.
- The report generated broader consensus that there is a problem (although not everyone agrees on the extent off the problem or has a common vision around what to do about the problem).
- Informally, there is growing discussion among the agencies to begin looking at more formal coordination
- There has generation of additional awareness that groundwater withdrawals can and do affect wetlands.
- Some permits have been denied to protect calcareous fens (groundwater-driven wetlands), due to the awareness of the potential impact on the wetlands from the proposed activities.

Cost Benefit Insights

Forthcoming

Information about Policy-related Issues

Minnesota's water appropriation statutes were formulated in an era when groundwater resources were viewed as essentially unlimited. Allocating water resources in an environment where those resources may in fact be limited calls for additional research and discussion. Minnesota's statutes and rules may need to be revised to provide better guidance. The DNR is currently researching potential models of water allocation systems used in other states and regions as part of this larger discussion[5].

Additionally, local governments, through their land use decisions, also play a significant role in determining the number and nature of residential, commercial, and industrial water users. Demand for agricultural irrigation is less affected by, though not disconnected from, local land use decisions. Under Minnesota's riparian water law system, there is no "first in time, first in right" determination and a new permit applicant has no greater or lesser priority than an existing permit holder under state statute, assuming both wish to use water for the same purpose. In planning for future development, local governments should carefully

[4] https://files.dnr.state.mn.us/waters/gwmp/thresholds/gw-thresholds-project_wetlands.pdf

[5] https://files.dnr.state.mn.us/waters/gwmp/thresholds/gw-thresholds-project_report.pdf, p.34

consider the sustainability of their water supplies and the extent to which new water-intensive uses should be encouraged or allowed under zoning and other local regulatory controls. A planning process that considers the needs of all existing water users, future needs, and opportunities for water conservation can help to sustainably manage existing and proposed uses[6].

Challenges & Lessons Learned

Forthcoming

Next Steps

The DNR is working with stakeholders, including permittees, local and regional agencies, legislators, and state water management agencies, to develop and refine potential statutory language. Additional changes to state rules will likely be needed in order to align with the new statutory language and provide more detailed discussion of the process for setting thresholds and sustainable diversion limits. The approaches recommended by the partners for establishing protected flows, protection elevations, and sustainable diversion limits for streams, lakes, and wetlands have not yet been applied in Minnesota. The DNR intends to continue implementing and evaluating these approaches in various settings where surface water resources appear vulnerable to groundwater appropriations. The results of these evaluations may also be valuable in updating and clarifying state rules on water appropriation management.[7]

Transferability

Forthcoming

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Additional Resources

- Report to the Minnesota State Legislature: Definitions and Thresholds for Negative Impacts to Surface Waters https://files.dnr.state.mn.us/waters/gwmp/thresholds/gw-thresholds-project_report.pdf
- Minnesota DNR: Groundwater Webpage: https://www.lwvumrr.org/blog/groundwater-depletion-balancing-use-to-reduce-conflicts-in-minnesota
- Minnesota DNR's Draft Groundwater Strategic Plan: https://www.dnr.state.mn.us/gwmp/planning.html

[6] ibid

[7] https://files.dnr.state.mn.us/waters/gwmp/thresholds/gw-thresholds-project_report.pdf, p. 38

ASWM State Wetland Program Integration Case Study: Missouri

Cross-Program Wetland Coordination in Missouri

State Wetland Program Information

This case study[1] explores the integration efforts undertaken by the Missouri Department of Natural Resources (MO DNR) to promote coordination and collaboration of wetlands programs across the state. Created in 1974 under the Omnibus State Reorganization Act the MO DNR works to protect the state's land, air and water resources[2]. It's §401 program currently has a dedicated FTE of 1.5 with an additional 3 – 4 FTE representing department staff who have some wetlands and water quality standards-related responsibilities. The State Wetland Program has been active since the mid-1980s.

Type of Integration Effort

Recognizing that efforts to protect and preserve Missouri's aquatic resources are undertaken by several programs across the state, MO DNR began to host quarterly interagency meetings in an effort to reduce silos and increase collective impact. These quarterly meetings are an opportunity for wetland program staff from various stakeholder agencies to share knowledge and expertise, discuss upcoming projects and arising issues, and identify opportunities to collaborate. Rather than creating a new program or formal initiative

[1] Project Case Study Criteria: The Association of State Wetland Managers (ASWM) conducted interviews with representatives from state wetland programs actively integrating with one or more additional resource management programs operating within their state. Criteria for case study inclusion required eligible programs to demonstrate direct or indirect impacts of integration on watershed-level planning, implementation and/or outcomes documented using formal or informal performance measures. Further consideration was given to integrated programs with the ability to provide cost-benefit insights.

[2] MO DNR. (n.d.). About Us. Retrieved from https://dnr.mo.gov/aboutus.htm

which would likely require additional funding and staff, these quarterly meetings are a simple way to strengthen interagency networks with minimal expense and effort.

The state has also been working to engage citizens through "Our Missouri Waters," which aims to educate residents about the various programs that manage water resources and promote a watershed perspective. The project coordinates with 319 program projects, allowing for more wetland implementation work on the ground. NRCS funds are used to cost-shared on projects where work is being done or riparian areas.

Scale of Integration Effort

MO DNR's quarterly meetings are intended to promote a coordinated statewide perspective for protecting and preserving the state's aquatic resources. In addition to representatives from MO DNR and the Environmental Protection Agency (EPA), current partners include MO's Land Reclamation Commission, State Park System, Water Resources Center, Natural Resources Damages Fund, 401 Water Quality Certification program staff and the Soil and Water Conservation District's (SWCD) 319 program.

Project Leadership

While these quarterly interagency meetings are an informal partnership opportunity for all stakeholder agencies working to protect wetlands and aquatic resources within the state, the DNR has played an essential leadership role in this integration effort. DNR Environmental Supervisor Stacia Bax devised the program in 2012 in response to the volume of inquiries she was receiving from other programs and agencies. Mrs. Bax continues to oversee the ongoing coordination of the quarterly interagency meetings to date.

Integration Goals

MO DNR's goal in establishing quarterly interagency meetings was to increase coordination and collaboration of wetland and aquatic focused programs across Missouri. This is particularly important as many programs face restricted or reduced staff and funding capacity. Collaboration represents an opportunity to work together to meet ongoing programmatic needs, share knowledge and expertise, and pool funding for joint projects when appropriate. Strengthening Missouri's interagency network can increase both efficiency and effectiveness by providing a statewide perspective for protecting Missouri's aquatic resources. Through ongoing coordination MO DNR hopes to increase the collective impact of the programs participating in the quarterly interagency meetings.

INTEGRATED NETWORK IN ACTION

Missouri DNR is currently revising its Wetland Program Plan. During this process, MODNR is using its contacts made through these meetings to help it address WPP questions and get input on plans.

Integration Process Timeline

Prior to launching the DNR's quarterly interagency meetings, Environmental Supervisor Stacia Bax noticed an increasing volume of inquiries from both internal and external program staff from across the state. Given the siloed nature of their work many of these colleagues needed information regarding project details, regulations, and permitting issues. She recognized a need for greater information sharing and coordination among the many aquatic focused programs in Missouri. With the backing of DNR leadership, Bax began

to host informal quarterly meetings in September 2012 bringing program staff together to share knowledge and expertise, discuss upcoming projects and issues, and identify opportunities to collaborate. In the seven years since its inception partner programs have participated in trainings, implemented joint projects, and pooled financial resources when appropriate to increase their collective capacity to protect and preserve Missouri's aquatic resources.

Resource Investment

This integration effort requires minimal investment of both financial and staff resources. The primary investment is that of staff time, with each participating program sending a representative to attend the quarterly meetings. Additional investments beyond meeting attendance may be made should partner programs decide to initiate joint projects at their own discretion. The DNR, as the leadership organization for this initiative also has the nominal cost of coordinating these meetings including hosting the meeting, developing the agenda, printing materials and communicating with all partner programs. The EPA, in addition to serving as a partner program, may also serve as a potential funding source for proposed projects in which case their financial investment would increase. Funding from 319 grants has become more available to partner projects that include riparian restoration activities as well.

How Success Has Been Measured

Integration Outputs:

- Maximized staff time
- Greater quantity and quality of wetland restoration projects undertaken
- Increased educational opportunities – especially shared training and informational sessions (e.g. soil scientist and botanist led a training for partner agency representatives)

Integration Outcomes:

- Expanded focus on wetlands by the §319 Program.
- Heightened familiarity with different programs and staff members across the state.
- Development of relationships and networks that enable staff to have contact between the quarterly meetings (social capital)
- Ability to coordinate more effectively with the Conservation Department
- Changes in decision-making based on non-wetland staff knowledge of wetland issues (e.g. if a federal declaration in a flood area, can put spans instead of low water crossings and fish and wildlife partners to replace them).

Impact on Watershed-level Planning, Implementation or Outcomes

While the watershed-level impact of this integration effort has been slow and incremental developing a coordinated statewide perspective for managing Missouri's aquatic resources clearly has far reaching implications. To date cross-program coordination has increased alignment of project goals and interagency collaboration throughout the state. The sharing of knowledge and expertise has expanded understanding of regulation issues and permitting processes. And awareness of the important role of wetlands has helped prioritize restoration and mitigation efforts. Given these advancements and the growing interest in

collaboration it is anticipated that this integration effort will have long term impacts on watershed-level outcomes.

Cost Benefit Insights

No formal cost benefit analysis has been conducted for this project. However, it's minimal implementation expenses and requisite staff time indicate the MO DNR's quarterly interagency meetings are a cost-effective integration effort. By investing a few hours of staff time every three months participating programs gain access to the knowledge and expertise of colleagues, identify potential funding sources for restoration, and develop joint projects. An additional benefit of the MO DNR's quarterly meetings has been an increased awareness and understanding of regulations and permitting processes throughout state programs leading to more compliance particularly with land reclamation and 404 applicants.

Information about Policy-related Issues

This integration effort was an initiative developed by the technical staff. While the state is working on wetland water quality standards (WQS) and investigating §404 Assumption, they are not critical to the success or future of the integration effort. However, these efforts may be strengthened by access to the integrated expertise and connections, should they move forward.

Challenges & Lessons Learned

When establishing an interagency network, it is important to:

- Start small, drawing on the founding members' existing social capital and gaining buy-in from key influencers within the state.
- Expand membership slowly and methodically, adding new members as needs and interest grow.
- Consider how each organization can contribute to the collective conversation and find ways to incorporate nonregulatory agencies whose programs impact the state's aquatic resources.
- Keep meetings concise and adhere to an established agenda.
- Provide opportunities for all program representatives to be heard while ensuring order, timeliness, and mutual respect for all attendees.
- Ensure a diverse cross-section of aquatic program involvement. Some flexibility on subject matter may be required (for example MO DNR interagency meetings are exclusively focused on wetlands but include other issues pertaining to the protection of Missouri's aquatic resources).

Next Steps

Given current budgetary restraints and staff capacity the MO DNR's quarterly interagency meetings will likely continue at the current scale for the foreseeable future. Ongoing efforts will be made to recruit additional programs and increase the groups focus on wetlands. Future topics of interest may include examination of the science and technology behind agency decision making and the implementation of a state programmatic multi-media e-permitting system.

Transferability

Given the minimal expense and implementation effort required, MO DNR's cross-program integration effort is highly transferable to other states where resource agencies have been siloed. With buy-in from management and a commitment from frontline staff to attend regular meetings states who launch similar efforts are likely to strengthen interagency networks promoting collaboration and coordination of wetland projects across the state. One essential component for success is to have a designated staff member from a leading agency to coordinate the meetings.

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Additional Resources

Partner Programs

- Missouri Department of Natural Resources
- EPA in Missouri
- MO Land Reclamation Commission
- MO State Park System
- MO Water Resources Center
- MO Natural Resources Damages Fund
- MO 401 Water Quality Certification Program
- MO Soil & Water Conservation Districts

ASWM State Wetland Program Integration Case Study: Nebraska

Incorporating Wetlands into Reservoir Rehabilitation Projects for Fisheries and Other Benefits in Nebraska

State Wetland Program Information

This case study[1] explores the integration efforts undertaken by the Wildlife Division of Nebraska's Game and Parks Commission. The Commission's Fisheries Division established the Nebraska Aquatic Habitat Program in 1997. The Aquatic Habitat Program partners with other NGPC divisions, other state and local agencies, and conservation organizations. The program is led by a single staff member who coordinates restoration and rehabilitative efforts statewide. The program predominantly relies on partners and grants to fund projects throughout the state.

Type of Integration Effort

The Aquatic Habitat Program brings stakeholder agencies together to focus on projects that address aquatic habitats (e.g., lotic, wetlands, lentic) with restorative activities (e.g., sediment removal, shoreline

[1] Project Case Study Criteria: The Association of State Wetland Managers (ASWM) conducted interviews with representatives from state wetland programs actively integrating with one or more additional resource management programs operating within their state. Criteria for case study inclusion required eligible programs to demonstrate direct or indirect impacts of integration on watershed-level planning, implementation and/or outcomes documented using formal or informal performance measures. Further consideration was given to integrated programs with the ability to provide cost-benefit insights.

protection, wetland development, watershed improvements) that benefit fish and wildlife habitats and water quality.

Scale of Integration Effort

The Aquatic Habitat Program is a statewide effort to "improve conditions for aquatic life through better management or rehabilitation of existing resources and [collaborate] with partners to build new waters to make them the best they can be. Funding for this program is provided by the purchasing of the Aquatic Habitat Stamp which is included in the price of [a] fishing license… The legislation establishing the [State's] Aquatic Habitat Stamp required a written plan identifying which waters were impaired and the type of work needed to restore them to productive healthy habitats. Funding is restricted to only those waters listed on the Aquatic Habitat Plan."[2] While most of the funded projects focus on the management and rehabilitation of Nebraska's many reservoirs some projects include other aquatic resources such as trout streams and the Sandhill Lakes.

Integration Goals

Integration enables the Aquatic Habitat Program to strengthen the feasibility and outcomes of its projects by drawing upon expertise and funding across agencies to implement a holistic approach to managing the State's aquatic resources. While the primary goal of the program is improved fish habitats and angler access, the understanding that water quality is an essential component for healthy fisheries is a fundamental tenet of this collaborative approach. Partnering with agencies whose expertise span the interdependent aspects of regional water quality has led to comprehensive project goals addressing healthy wetlands, in-lake structures, watershed best management practices (BMPs), and incorporation of lacustrine fringe and other vegetation. The initial plan prioritized 53 projects throughout the state that would benefit anglers and revitalize aquatic habitats. This included hiring contractors to reconfigure the footprint of reservoirs to create deeper waters near the shoreline to improve bank angler access, interspersed with shallow vegetated areas conducive to fish and other wildlife. Piers and rock jetties were also utilized to increase angler access to deeper water.

Integration Process Timeline

Predominantly constructed in the 1960s and 70s, many of Nebraska's reservoirs had begun to deteriorate by the early 1990's. "Basins had filled with silt, shorelines had eroded, water quality had degraded, and less-than-desirable fish communities made for poor angling."[3] At many locations shallow, muddy water made it impossible for anglers to bank fish from the shoreline.

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[2]Aquatic Habitat Program.(2018, October 19). Retrieved fromhttp://outdoornebraska.gov/aquatichabitatprogram/

[3] Magazine, N. (2018, July 05). Aquatic Habitat Program Celebrates 20 Years. Retrieved from http://magazine.outdoornebraska.gov/2018/06/aquatic-habitat-program/

A committee was formed in 1993 to develop a revitalization plan for these important aquatic resources with the goal of improving fish habitats and increasing angler access. The committee was comprised of representatives from wildlife, wetlands and fisheries as well as the department of environmental quality. The committee held 19 public meetings across the state that first year, with more than 650 anglers attending to "discuss problems and possible solutions related to aging reservoirs and aquatic habitat."[4] The following year a three day conference was held convening seventy anglers along with biologists and other experts to "[identify] priorities and [develop] a course of action for addressing the state's aquatic habitat issues."[5] Through these conversations the committee developed the framework for Nebraska's innovative Aquatic Habitat Program and Aquatic Habitat Stamp.

The planning process continued for another three years as the committee identified solutions and best practices to both revitalize the state's aging waters and address anglers' concerns. New legislation was passed in 1996 implementing the Aquatic Habitat Stamp generating funds for the implementation of selected projects.

"More than 20 years later, sales of the stamp have generated more than $22 million for improvements to 122 waterbodies across the state. Many additional funding partners (73), including the Nebraska Environmental Trust Fund, the Federal Sport Fish Restoration Fund, Natural Resources Districts and cities across the state, have contributed an additional $73 million for Aquatic Habitat Program projects, which have improved water quality, removed sediment, stabilized shorelines, added submerged aquatic habitat structures, provided for the construction of fishing docks and piers and much more."[6]

Addressing the Issue of "Aging Waters"

When first constructed reservoirs receive a tremendous biological pulse lasting fifteen to twenty years. After this initial period, they begin to fill with sediment and are considered "aging waters". The deterioration of water quality is often amplified by a lack of vegetation along the reservoir shoreline leading to erosion and additional sediment deposits. These compounding issues often lead to shallow muddy waters and a loss of heathy habitats for fish and other wildlife, which in turn results in reduced opportunities for anglers and other aquatic recreation.

Project Leadership

The Fisheries Division of the Nebraska Game and Parks Commission leads the Aquatic Habitat Program with partnerships varying according to the scope and sale of each project. The Wildlife Division's Wetland Program manager serves on the Aquatic habitat Committee, which reviews project proposals. Current and past partners include; the department of Environmental Quality, the Army Corps of Engineers, the Bureau of Reclamation, the Natural Resources Conservation Service, Ducks Unlimited, and angler clubs. Additionally, the Aquatic Habitat Program works closely with local cities and towns as

[4] ibid

[5] Magazine, N. (2018, July 05). Aquatic Habitat Program Celebrates 20 Years. Retrieved from http://magazine.outdoornebraska.gov/2018/06/aquatic-habitat-program/

[6] ibid

well as the State's twenty-three Natural Resource Districts (NRDs) which have the authority to levy local property taxes for irrigation, flood control and recreation.

Resource Investment

Resources from several agencies support the Aquatic Habitat Program. The Program Manager is a Nebraska Game and Parks Commission staff member. District Fisheries staff provide support for specific projects. Funding through the Aquatic Habitat Stamp is supplemented by fisheries and U.S. Fish and Wildlife Service federal aid cost-sharing funds as well as EPA 319 funding. Additional support is provided through the Nebraska Environmental Trust, a state-run entity that distributes state lottery funds through a grant program.

How Success Has Been Measured

Nebraska's Aquatic Habitat Program has identified the following output and outcome metrics to gauge their success:

Integration Outputs:

Goals are set each year for the number of projects completed. Funding sources are also tracked with a per-project cost analysis identifying the percentage of funding leveraged through the stamp verses additional resources. Angler surveys provide qualitative reporting on the impact restoration projects have on fish communities and angler success.

Integration Outcomes: In order to quantitatively track outcomes of restoration projects before and after fish sampling is conducted to identify specific distribution and abundance of target game fish. This is supplemented by qualitative and quantitative reports through fishermen creel surveys inquiring how many and what type of fish they catch as well as where they live, how many hours they spent fishing, and how many fish were caught per hour. This combined data depicts the structure of the fish community at each project site. Qualitative reporting on the impact of revitalization projects on wildlife is also utilized through staff observations noting decreases or increases of sightings. Additionally, some projects require further reporting on water quality parameters. Structural improvements that enhance fisheries and water quality also increase recreational use of the waters. Furthermore, as public awareness of the Aquatic Habitat Program's success grows program staff are continually sought out for advice on improving fisheries, wildlife and recreation in other areas. Finally, the restoration projects undertaken by Nebraska's Aquatic Habitat Program also present an important opportunity to raise awareness and educate partners about water quality, recreational activities, and flood control. It is an opportunity to improve understanding of wetland management, fish communities and the use of vegetation to develop healthy habitats and improve water quality.

Impact on Watershed-level Planning, Implementation or Outcomes

While the large flood control projects of the 1960s and 70s have come to an end, there are still several new projects under construction with partners like the Army Corps of Engineers, NRCS, and local natural resource districts. This integration process has had a significant impact on the planning and implementation of these projects. Today, fisheries staff and other natural resource experts play a key role in the initial design and planning process working with design engineers to ensure essential features are incorporated in construction which extend the life span of these waters and their fish populations. Special consideration is given to fishery accommodations such as where anglers get access, what wildlife might benefit, building jetties, shoreline stabilization and shoals. Proactively incorporating these features during construction is a more cost-effective approach when compared with the expense of restoration.

Cost Benefit Insights

While there has not been a formal cost-benefit analysis conducted on this project, the project leadership has been able to identify key benefits that have clear positive financial implications. There has been an increase in public use of restored reservoirs. For example, they are more pleasant to use and fishermen can walk on the jetties and fish from shore. Before and after fish data have shown increases in priority fish species abundance and size. Some of this information has been collected both at the state and the national level (National Fish and Wildlife Survey). Creel surveys that measure angler use days also have shown an increase in number of trips and associated purchases of lodging, gas and food. There have also been monies leveraged through collaboration that have resulted in increased and higher quality restoration projects occurring than would otherwise have been possible through individual agencies.

Other Impacts

In addition to the above-stated benefits, there have been downstream water quality improvements as water quality improved upstream. Not all benefits to this area have been accrued solely from the reservoir restoration projects, but these projects have contributed as part of a larger suite of improvements that reduce nutrients and sedimentation from upstream. The portion of Antelope Creek downstream form Holmes lake has now been removed from the impaired waters list for the state and a 100+ year rain event did not flood the business community for the first time since the restoration work was completed, resulting in huge savings in avoided flood damage and clean-up costs.

Information about Policy-related Issues

This collaborative project required Nebraska Game and parks Board of Commission action. The Commission is a politically-appointed board. A bill had to be introduced to the state legislature to set up

the required legislative action. The passing of this bill was the primary driver for the project. It is important to note that timing has played a significant role in the success of this project, as the state had formed The Nebraska Environmental Trust at the same time.

Challenges & Lessons Learned

This project was designed to be adaptive in order to address emerging needs. The partners have improved the system over time, as well as the wetland fringe. Wetlands need periodic drawdowns to reestablish vegetation. New practices have evolved to allow a one-foot drawdown for some projects in the late spring and early summer while the new design also provides deep areas next to shore that can be used by fishermen during drawdowns to support public demand and use. The incorporation of deep water near shore and jetty access has resulted in increasing interest and demand for this restoration work in other areas of the state.

Next Steps

The Aquatic Habitat Program is an ongoing initiative. As the program continues its restorative work, implementation of current best management practices and lessons learned from completed projects play a pivotal role. This includes revisiting earlier projects to make adjustments as needed. Additionally, to ensure new reservoirs incorporate features that extend their lifespan the program "provides technical assistance on reservoir design and construction methods, and sometimes financial assistance to incorporate in-lake fish habitat, shoreline angling areas and boating access to these new public waters."[7]

Transferability

This integration project is most transferable in states with extensive land and a small population. Partnerships are essential to the success of the Aquatic Habitat Program. The support of the angler population is important when considering the implementation of an Aquatic Habitat Stamp to fund restoration projects.

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[7] Nebraska Aquatic Habitat Program Website

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Additional Resources

- Aquatic Program Website
- Holmes Lake Water Quality Project 319 Report
- Holmes Lake Restoration Factsheet
- Nebraskaland magazine Article
- Paper on how to incorporate wetlands into reservoir rehabilitation projects
- Legislation Link
- Wetland Program Plan – Wetland Management Document
- Fisheries Survey

ASWM State Wetland Program Integration Case Study: New Mexico

Integrating Wetlands into Nonpoint Source Plans and 319 Projects

State Wetland Program Information

This case study explores the integration efforts undertaken by the New Mexico Environment Department (NEMD). The New Mexico Environment Department Surface Water Quality Bureau (SWQB) Wetlands Program developed its first wetland program plan in 2003. The NMED has an active wetland program under the leadership of Maryann McGraw. The Wetland Program has undertaken several innovative approaches to wetland management over the last decade and is committed to conserving and protecting wetlands that play a critical role in the arid state.

Type of Integration Effort

This effort has worked to elevate the role of wetlands in nonpoint source pollution planning activities and, specifically, Total Maximum Daily Loads (TMDLs). Wetland Action Plans have been developed to serve as an alternative option to the use of watershed-based plans in determining 319 funding activities. While hydrologic alterations are not a pollutant, they do threaten wetlands and water quality. Wetland Actions Plans focus on protective measures, rather than specific water-quality measures.

Scale of Integration Effort

This integration effort addresses all waters statewide, except tribal waters not under state jurisdiction.

Project Leadership

All partners in this project were internal to state government and within the New Mexico Environment Department Water Protection Division. The Division contains both a Surface Water Section and a Watershed Protection Section. The Wetlands Protection Section contains three teams: 1) the Wetlands Team,2) the Implementation and Restoration Team (which includes the 319 program), and 3) New Mexico Field Offices (which manages 319 implementation). The collaboration integrates the three teams under the Wetlands Protection Section and is led by Abe Franklin, the Watershed Protection Section Chief and the Wetlands Team, which is led by Maryann McGraw. All three teams provide oversight and management collaboratively. By the nature of this wetland work and 319 projects, the NMED integration team works extensively with nonprofits as well.

Integration Goals

The primary goal of this integration approach is to protect against a major threat to water quality. The state developed this effort to recognize that wetlands are waters that should be included in watershed plans, even though they are not in the 303(d) listed category of waters to work on. The state's efforts have looked instead at water corridors that are inclusive of not only rivers and streams, but wetlands and depressions. Water quality goals cannot be achieved without including adjacent wetlands, so the approach focuses on whole hydrologic systems. While riparian areas are critical in the arid West and linear riparian wetlands overlap with what is going on in streams, riparian areas are often undervalued. Staff endeavor to enable more innovative designs through the use of Wetland Action Plans, including how project planning is conducted and more integrated reporting.

This innovative approach: 1) makes possible the piggybacking of wetland program plans on regulatory documents required for restoration planning; 2) makes the use of non-wetland program funding to support wetland restoration possible (expanding the potential for water quality gains), and 3) expanded wetland mapping (which identifies opportunities to improve not only wetlands, but watersheds as a whole).

Integration Process Timeline

Wetland Action Plans (WAPs) are unique to New Mexico. They have been part of New Mexico's Wetland Program Development Grants since 2003. The development of Wetland Action Plans has been funded in each round over the last three EPA grant competitions. In 2014, new NPS guidance documents listed watershed-based plan alternative categories for use in determining 319 funding decisions. Conversation about opportunities this presented began in New Mexico as a result and the state was soon approved to submit WAPs as an alternative to a watershed-based plan. New Mexico started by listing for the first time a new milestone in its state 319 Program plan to develop a state Wetland Action Plan for one priority watershed. In 2018, the state began to pursue even greater integration. To date, the state has developed 12-15 Wetland Action Plans. While integration efforts have been modest to date, the potential to expand integration is gaining momentum.

Resource Investment

In the short-term, most of the investments in this integration effort have focused on investments of staff time required to develop Wetland Action Plans. The Section Chief has invested approximately 20 hours in this effort over the last 12 months. The Wetland Team leader also provided approximately 20 hours during this same time on working with the 319 staff towards the development of these plans. Other staff time is estimated to total an additional 20 hours of time among them. Staff time has been spent primarily on developing presentations, holding discussions, coordinating a portion of the state's workshops (total one day), and the attendance of approximately 20 non-DEP staff in that event. In the long-term, staff envision increased consideration of wetlands in NPS plans. The amount of consideration is still relatively small but could evolve into a greater role.

Impact on Watershed-level Planning, Implementation or Outcomes - How Success Has Been Measured

Integration Outputs:

- The development of Wetland Action Plans that can be used in wetland restoration planning and the determination of restoration priorities for 319 funds.
- A collaborative internal approach to addressing watershed issues that more actively includes the restoration of wetlands.
- A competitive project application process (including a problem definition section in each application which requires identification of the target stream system, water quality problem, information about the stream's TMDL, information about loading in excess of the TMDL and other information.
- The production of technical publications annually.

Integration Outcomes:

Programmatic

- Recognition by EPA of a broader view of the NPS Program.
- Resulted in a huge paradigm shift around wetlands – wetlands are now part of the conversation about watershed health and restoration.
- The use of Wetland Program Plans as an alternative to watershed-based plans to determine §319 projects and restoration priorities.
- Access to additional funding to support wetland restoration.
- Staff and partners better trained in rapid assessment methods
- Better coordination between NMED Watershed Protection Section teams working on restoration activities.
- EPA and other federal agencies are now more aware of the value of wetlands for watersheds and the potential improvements that could be achieved by making wetland restoration activities eligible for §319 funding, laying the groundwork for the future use of 319 funds to directly support wetland restoration work.

Environmental

- Greater quantities of wetland restoration as a result of more funding for these efforts.

- Improvements in headwaters (though issues have not been fully solved).
- Better mapping of wetlands.
- Better targeting of stressors and their impacts on wetlands.

Outreach

- Reinvigoration of watershed organizations in the state, as they were interested in doing work that had additional social and ecological benefits.
- Public increased their recognition that not every wetland is a riparian area.
- Watershed organizations increasingly recognized the range of functions provided by wetlands in their watersheds.

Cost Benefit Insights

No specific benefit-cost analysis has been conducted for this integration effort. However, staff identify that a small investment in staff time and meeting expenses has resulted in more comprehensive consideration of water resources, the potential to more effectively reduce impacts to water quality, and the ability to more adequately assess and address wetland stressors. The ability to access 319 funds for additional wetland restoration activities has positive ramifications for the NM Wetlands Program and other sections in the Water Protection Division.

Information about Policy-related Issues

No information provided.

Challenges & Lessons Learned

- Both state and federal agency staff were initially cautious about considering WAPs for these purposes. However, there was not pushback.
- Initially, staff had a hard time envisioning how a Wetland Action Plan could substitute for a watershed-based plan.
- In the §319 program, each state develops an NPS program, funded by no more than 60% of federal funds. The lack of state funding to cover this can lead to problems and competition for these limited funds.

Next Steps

Currently most applicants do not have the resources available to qualify. In the future, the NM Environment Department would like to require that the problem description be framed in terms of a Rapid Assessment Method (RAM) assessment to show a C or D rating of the water body.

NM Environment Department would like to move towards the use of a stressor checklist and the more effective use of these lists in planning and prioritizing projects. The process would include a subjective statement from the applicant with their opinion on the impact of the stressor and why. This information could be used to justify restoration or protection of a wetland.

Although there are no plans to develop them, staff are interested in exploring the concept of Total Maximum Levels of Stress (TMLS) for wetlands (like TMDLs) to help identify the level of stress affecting a specific wetland and inform efforts to mitigate impacts through restoration. TMLS would be used to help the state prioritize restoration sites.

Transferability

As Wetland Action Plans are unique to New Mexico, there are some limits to the current transferability of this integration approach. However, EPA's NPS guidelines list Watershed-based Plan alternatives categories. Other states could identify one of these alternatives to use in place of New Mexico's WAPs. Any state or tribe seeking to explore alternatives should engage in discussion with EPA early in the process to determine if their proposed alternative would qualify as an NPS Watershed-based Plan alternative under §319 requirements.

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Additional Resources

- New Mexico Nonpoint Source Management Plan (2014)

ASWM State Wetland Program Integration Case Study: Vermont

Integration of the Vermont Watershed Management Division's Water Quality Monitoring Programs: Combining Wetland, Lake and River Program Monitoring

State Wetland Program Information

This case study[1] explores the integration efforts undertaken by the Vermont Wetlands Program in partnership with an array of state agency partners, as well as other "satellite programs". Vermont's Wetlands Program is run by one manager, six regulatory staff and 1.25 FTE monitoring staff.

Type of Integration Effort

This project brings together wetland management, water quality monitoring and watershed planning by integrating all freshwater resource monitoring programs in Vermont.

Scale of Integration Effort

Monitoring programs are integrated through collaboration at the statewide level.

[1] Project Case Study Criteria: The Association of State Wetland Managers (ASWM) conducted interviews with representatives from state wetland programs actively integrating with one or more additional resource management programs operating within their state. Criteria for case study inclusion required eligible programs to demonstrate direct or indirect impacts of integration on watershed-level planning, implementation and/or outcomes documented using formal or informal performance measures. Further consideration was given to integrated programs with the ability to provide cost-benefit insights.

Integration Goals

The Vermont Wetland Program and its partners are working collaboratively to achieve the following integration goals:

1. Create a watershed-approach to monitoring
2. Identify Division monitoring priorities and anticipate future needs
3. Develop strategies to make sure program priorities support division priorities
4. Integrate staff monitoring efforts for efficiency
5. Specific to the Wetlands Program, the project also worked to increase biocriteria development collaboration; VRAM usage by other Programs; and use of processes that allow for identification of targeted sites for condition assessment (using Basin Plans, where other programs have existing data, etc.).

Integration Process Timeline

2016-2017 Tested "new business process" that was created after a three-day LEAN event in which monitoring programs within the Division met and worked out a plan together. Held a "pilot" meeting for 2016 field season and went through the whole process for planning the 2017 field season.

2018 -Future This process (see below) will occur each year in a multiple-step Implementation Plan to determine site selection for each upcoming field season

Annually, the partners conduct the following process:
1. Late Fall through Mid-Winter: Basin Planners review Implementation Table to highlight areas that need to be addressed and share this information with programs.
2. Division Monitoring Programs meet on a monthly basis from late fall through mid-winter to discuss program updates and logistics, priorities, big-picture planning, and integration efforts for annual "Summit" Meeting
3. Before Summit Meeting, Individual programs create priority site list for based upon feedback from Basin Planners, outside programs, and own program priorities
4. Individual programs create Priority Site List based upon feedback from Basin Planners, outside programs, and own program priorities
5. Gather program priorities for upcoming Basin(s)
6. Hold Summit Meeting (mid-winter) Programs present specific priorities to Division-wide technical group Explore geographic areas in Basin(s) for integrated monitoring efforts a. Watershed approach to sampling b. "cross-pollination" opportunities c. Identify suitable monitoring activities for volunteer monitoring programs/affiliates
7. Develop Monitoring Plan
8. Conduct plan updates at program level
9. Update Water Quality Monitoring Strategy
10. Deploy into field season with monitoring plan
11. Meet to review planning process for next field season

Project Leadership

Vermont's monitoring integration project involves an array of state agency partners, including leadership by the Watershed Management Division Director and partners from the Wetlands Program, Lakes and Ponds Program, Rivers Program, and Monitoring, Assessment & Planning Program. Additionally, the Monitoring, Assessment & Planning Program coordinates the annual Monitoring Summit. Other "satellite" programs involved in the project include the state's Stormwater Program; Forest, Parks & Rec, Waste Management Division, Wastewater Program; and Clean Water Initiative Program, as well as a few others in peripheral ways.

Resource Investment

Coordination for this integration effort has been supported by long term funding of the Federal EPA Performance Partnership Grant (PPG). Section 106 of the Clean Water Act requires states to develop a monitoring Program strategy. The two objectives of the Vermont Water Quality Monitoring Strategy are directly applicable to this work: 1) Communicate, collaborate and coordinate on a regular basis with organizations, agencies, municipalities, and the general public to assure complementary monitoring programs and 2) Integrate monitoring and assessment with management actions.

How Success Has Been Measured

This project has a number of measurable outcomes to track progress in achieving its integration goals. Currently, the project measures and tracks the following:

1. Creation of monitoring site plan for each field season
2. Number of sites visited to meet implementation goals
3. Number of potential restoration sites identified through integrated monitoring results
4. Number of sites where protections are "achieved" based on integrated monitoring results [Examples: Class I wetland designation, reclassification of surface waters, designating watersheds/ surface waters as Outstanding Resource Water (ORW)]
5. Number of sites sampled for multiple programs that lead into a greater understanding, protection or remediation about a particular watershed.

Impact on Watershed-level Planning, Implementation or Outcomes

This project has been designed to result in the following watershed-focused improvements: 1) improved tactics for watershed-level planning, 2) improved implementation of monitoring efforts to meet Division priorities, and 3) improved efforts in protecting, maintaining, enhancing, and restoring the quality of Vermont's surface water resources.

Cost Benefit Insights

At this stage in Vermont's integration effort, it is not known what the cost-benefit ratio will be for implementing these integration efforts.

Benefits

It is expected that through these efforts, Vermont will accrue the following benefits, which will be documented:

- Integrated monitoring efforts to achieve Division-level goals of protecting, maintaining, enhancing, and restoring the quality of Vermont's surface water resources by identifying watershed level restoration potential, high quality protection areas, and identifying permitting successes or issues. Identify specific areas on the landscape which are in need of protection or restoration action. Better understanding of the quality of water as it travels downgradient.
- Career development opportunity for field monitoring staff
- Optimized field staff time by cross-training among different monitoring programs to collect data. This will hopefully allow for the collection of more data across different media.
- Greater resource sharing coordination.
- Increased peer group for small Wetland Bioassessment program, allowing for greater vetting of ideas and suggestions for monitoring approach.

Costs

These benefits will be made possible through expenditures to cover the following costs:

- Time involved planning integrated monitoring efforts for each field season
- Staff time to review Basin Plan Implementation Tables and other program priorities
- Staff time to develop site selection priorities for each program that encompass Division priorities
- Staff time for meeting preparation and coordination

Other Impacts

In addition to the above-stated benefits, there have been positive environmental, efficiency, economic and regulatory effectiveness impacts. In terms of the environment, the integration project has increased protections of high-quality sites and restoration of impaired surface waters. Cross-program coordination provides greater information on more waterbodies. This in turn can lead to more sites being proposed for classification and protection, increasing overall effectiveness. Economically, becoming more efficient with monitoring operations keeps expenses low. Finally, coordination results in increases in regulatory effectiveness by collecting and providing the correct information when needed for wastewater treatment plant permit reasonable potential determinations, waste management permits near impaired sites and TMDL identification and stressor identification.

Information about Policy-related Issues

Integration is encouraged in the Vermont Agency of Resources, and specifically within the Watershed Management Division. The Division's Monitoring Programs went through a three-day LEAN event to encourage integration of monitoring efforts. Additionally, in Vermont, the Clean Water Act requires the use of the Tactical Basin Plans and Implementation Tables to identify the highest priority actions that will receive state funding in order to restore or provide higher protections to surface waters. Monitoring and assessment work identifies and informs the Tactical Basin Plan of priority protection and remediation sites, specific media, multiple media, and whole watersheds. Monitoring is key to determine whether restoration and protection projects and permits are working effectively.

Types of surface water protection in Vermont:

- Class I designation: highest level of protection under the Vermont Wetland Rules for wetlands that are considered exceptional and/or irreplaceable to Vermont's natural heritage. Only allows permitted impact if there is a compelling need for public health or safety and increases the regulated buffer width. This designation process often takes a lot of time due to the designation requiring a rule change, which is ultimately decided by the state's legislature.
- Reclassification of other surface waters as part of the Tactical Basin Planning process.
- Outstanding Resource Waters

Identification of sites through monitoring and assessment that are impaired, disturbed, or downward trending that need restoration to meet TMDLs and VT Water Quality Standards. For Ecosystem Restoration Grant funding, a water quality improvement project must be identified in a tactical basin plan, which heightens the need for integrated monitoring information

Challenges & Lessons Learned

Vermont documents several lessons learned from their integration efforts that may serve as useful guidance to others seeking to undertake similar efforts.

The Vermont project needed to invest in neutral facilitation during multi-program meetings in order to stay on task, which was a challenge without this meeting support. They have also found the delegation of duties to be tricky in the integrated planning environment. They share that it takes additional time and effort to plan for meetings and site selection in the integrated setting as decisions must take into consideration and balance different division's priorities. They have found that it can be difficult to coordinate multiple programs for meetings. To make this coordination happen effectively, buy-in to the integration work and meetings is necessary from both agency leadership and staff.

On a more practical level, they also share some program-related lessons learned. To allow enough time to get everything completed, staff members have found that they need to begin planning for next sampling year soon after the end of the present year. They have also identified the need to create database architecture in ways that hold and store site locations based on the results of the integrated decision-making rubric.

Next Steps

Vermont plans to continue to develop and enhance their integration efforts. To this end, they are slated to 1) continue using the "new business process" to determine site selection for next year's field season and 2) annually review each previous year's "business process," looking at what worked, what didn't and how to improve.

Transferability

While this initiative is transferable to other states, some elements of the context within which this effort has been developed are unique to the State of Vermont. Integration in this manner may be a "smoother" process to assimilate in Vermont because the primary monitoring programs are all housed under the same Division (Watershed Management). Also, monitoring has been the foundation for the creation of Tactical Basin Plans which are updated every 5 years. Other states that have similar processes with rotational basin schedules and basin/ watershed plans may be able to proactively align individual program goals to meet bigger picture goals. If states do not have a similar watershed planning process and funding, monitoring efforts are contracted out, or do not exist at all, it may be a more difficult conception to bring such collaborative efforts to reality.

A primary driver behind greater collaborative monitoring efforts was through the passing of the Clean Water Act in 2015, which strengthens multiple water quality statutes in the state and also requires that all water quality improvement actions undertaken by the State be integrated by means of the Tactical Basin Plans. A program housed within the Watershed Management Division, known as the Clean Water Initiative Program (CWIP), directs state funding toward implementation of priority projects identified in the TBP's. These plans are developed based on the monitoring efforts of individual programs that assess water quality in various media throughout a basin that help to identify and prioritize actions to improve and protect water quality.

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Additional Resources

- http://dec.vermont.gov/watershed/map/basin-planning - Tactical Basin Plans
- http://dec.vermont.gov/watershed/cwi/cwf - Clean Water Fund
- http://dec.vermont.gov/watershed/cwi - Clean Water Initiative Program
- http://dec.vermont.gov/watershed/map/strategy - Vermont Surface Water Management Strategy
- https://anrweb.vt.gov/PubDocs/DEC/WSMD/mapp/docs/mp_MonitoringStrategy2015.pdf - VT DEC Water Quality Monitoring Program Strategy
- http://dec.vermont.gov/sites/dec/files/wsm/boss/docs/WSMD-Strategic-Plan_2016-2018.pdf - WSMD Strategic Plan 2016-2018

ASWM State Wetland Program Integration Case Study: Vermont

Wetland Restoration and TMDLs in Vermont's Lake Champlain Basin

State Wetland Program Information

This case study explores the integration efforts undertaken by the Vermont Agency of Natural Resource's Wetlands Program to achieve the Lake Champlain Total Maximum Daily Load (TMDL) phosphorus reduction goals through wetland restoration and protection. Vermont's Wetlands Program is run by one manager, six regulatory staff and 1.5 monitoring staff.

Type of Integration Effort

This project promotes collaboration between the Wetlands Program and various federal, state, and local partners in identifying and implementing protection and restoration opportunities in areas of the Lake Champlain Basin with potential for offering critical wetland functions such as flood retention, water quality improvement, and erosion control.

Scale of Integration Effort

The Vermont Wetlands Program is coordinating a statewide wetland restoration effort. This project focuses on increasing the number of natural wetlands and improving wetland functions within Vermont's portion of the Lake Champlain basin through collaboration with public and private, federal, state, and local partners.

Project Leadership

The Vermont Wetlands Program co-leads this integration effort with current and past partners including the Vermont River Program, the Nature Conservancy, the Natural Resource Conservation Service, Vermont Housing and Conservation Board, Vermont Fish and Wildlife, US Fish and Wildlife, Tout Unlimited, Vermont Agency of Agriculture and Food Markets, Ducks Unlimited, and various local land trusts.

Integration Goals

By integrating the Wetlands Program with various partners, the Wetlands Program aims to achieve no net loss of wetland or wetland function in the Champlain Basin as a means of recognizing important components in the Lake Champlain TMDL. Specifically, the project is intended to help the Wetland Program achieve phosphorus reduction goals set for Lake Champlain.

Integration Process Timeline

- Planning: 2016-2018
- Implementation: 2016-ongoing
    - Fall 2017: Partner Meetings established; Restoration modeling outreach.
    - Winter 2018: Database and protocol to improve tracking of statewide wetland conservation, enhancement, restoration, and creation.
    - Monitoring: Restoration monitoring initiated in 2018- ongoing.
- Summer of 2019 and beyond: Creation of a Statewide restoration planning strategy; continued Partner meetings; ongoing wetland restoration monitoring.

Resource Investment

- Planning: Restoration priority map and calculator development: $250,000
- Implementation: $1,000,000-$3,000,000 annually
- Monitoring: $60,000
- Continual: staff time for coordination and outreach. Ongoing conservation and restoration funding required.

How Success Has Been Measured

Integration Outputs:

- Updated a wetland restoration prioritization model that identifies and prioritizes potential restoration sties based on their ability to attenuate phosphorus, which is now publicly available.
- Contracted a project to create site profiles for 250 of the highest-ranking Lake Champlain basin sites.
- Developed a Wetland Easement Landowner Payment Calculator.
- Established a regular “Restoration Round Table” of statewide restoration organizations to coordinate efforts.
- Wetlands program has drafted a model wetland easement.
- Initiated a wetland restoration monitoring project with input from NRCS and US Fish and Wildlife.

Integration Outcomes:

- Established close contacts with other wetland restoration and conservation entities.
- Improved ecosystem services including water quality, phosphorus retention, wildlife habitat, erosion control, and flood storage.
- Successful designation of the Sandbar Delta Wetland Complex from a Class II to Class I wetland.
- Successful designation of the LaPlatte River Wetland Complex from a Class II to Class I wetland.

- Incorporation of wetland restoration projects and potential Class I wetlands into Basin Plans.

Impact on Watershed-level Planning, Implementation or Outcomes

In establishing contact with other wetland professionals, the Wetlands Program has been able to identify, organize and track restoration and protection efforts of high priority ecosystems in the Lake Champlain Basin more efficiently and effectively. This should result in overall improved wetland functions in the region as well as more shared information and coordination on ongoing projects.

Cost Benefit Insights

- TNC with UVM is working on cost benefit analysis now, which should be available in 2019.
- Trust for Public Land commissioned by Vermont Forest Partnership found that one dollar of investment in land conservation has returned approximately $9 in natural goods or services. Valued intact wetlands as providing $590 annually in natural goods and services.

Other Impacts

- Non-monetary benefits
    - Water quality improvements in the Lake Champlain basin – qualitative, but over time quantitative.
    - Phosphorus retention in the Lake Champlain Basin – qualitative, but current studies hope to quantify in the coming few years.
    - Wildlife habitat protection, including RTE species - qualitative
    - Erosion control - qualitative
    - Flood storage – qualitative with some quantitative assessments available
    - Exemplary wetland natural community protection – quantitative
- Monetary benefits
    - Middlebury study: 1.8 million dollars of flood damage prevented according to a 2016 University of Vermont Study.

Information about Policy-related Issues

Wetland restoration and protection has been identified in the Lake Champlain Total Maximum Daily Load (TMDL) as a critical component to achieving the TMDL's phosphorus reduction goals. With these goals in mind it is critical to understand the quantity and quality of wetland restoration taking place in Vermont. With the help of recent Wetland Program Development Grants, the Vermont Wetlands Program has successfully established a wetland restoration program with a statewide presence, in order to track and document the work that is being done, which includes Wetland Reserve Easement projects, as well as many easements through the Vermont Land Trust and The Nature Conservancy. The goal of these restoration integrative efforts is to document, track and develop a long-term strategy for all organizations conducting wetland restoration and preservation work.

NRCS, in close partnership with US F&W, have been highly effective in implementing wetland easements with associated restoration on over 60 sites totaling over 3,000 acres in Vermont. In the last

three years Vermont has designated over 1,000 acres of Class I wetlands. Since 2017, the RCPP incentive project has committed incentive payments to wetland restoration projects totaling over 600 acres.

Challenges & Lessons Learned

Although state-wide restoration coordination has been applied, there are still barriers to wetland restoration implementation. Some of these include limited staff for outreach, limited funding for non-NRCS eligible projects, and lack of easement holders.

Restoration and conservation entities are eager to collaborate and leverage funds together. Regular communication within the restoration/conservation community ensures that efforts are distributed, organizations are not going after the same properties, collaboration opportunities can be identified early. We've heard from the restoration/conservation community that barriers to restoration and conservation (easements in particular) are that there are limited organizations that will hold small easements and that landowners do not want to keep these lands if they are still have a significant tax burden. Opportunities to address these challenges are to establish a stewardship collaborative, create a water quality land trust or expand coverage of land trusts, and address legislation to reduce taxes or otherwise incentivize conservation of natural areas.

Next Steps

- Develop a Statewide Strategy for Wetland Restoration
- Develop a restoration reporting protocol that includes Partner-specific restoration goals so that each organization's goals are tracked.

Transferability

This situation is unique to Vermont, as wetland restoration had been highlighted as a major goal of the Lake Champlain TMDL in order to achieve phosphorus reduction. This drove the need for a better understanding of what is happening with wetland restoration efforts in Vermont, as a tracking system for these projects did not exist. The Vermont Wetlands Program received grant funding to create a restoration "point" person within the Program to lead up wetland restoration coordination efforts. With Vermont being a "small" state, the Wetlands Program interacts often with other partners such as NRCS, ACOE, and non-profits like TNC, so relationships with other restoration partners had already been established.

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Appendix D: Watershed Project Snapshots

- **Beaver Creek Watershed**
- **Johnson Creek Watershed**
- **Anacostia Watershed**
- **Upper St. Johns River Basin**
- **Vermillion River Watershed**
- **Lewisville Lake Watershed**
- **Jemez River Watershed**
- **Yakima River Basin**
- **Delaware River Basin**

Beaver Creek Watershed Highlights

Initiative/Project Title:

Iowa Watershed Project

Watershed Location:

Beaver Creek, Floyd and Chickasaw Counties in Iowa

Watershed Size:

11,238 acres

Start-End Dates

2010-2016

Project Summary:

Flooding, high levels of nutrients, and high levels of sediment are some of the main issues in the Beaver Creek Watershed. Additionally, changing weather patterns and shifting land use are other challenges faced within the watershed. To address these issues, the Iowa Watershed Project is aiming to minimize soil erosion and sand deposition during floods, maximize the water holding capacity of soil, manage water runoff in uplands under saturated soil conditions, and to reduce and mitigate flood damage. For this initiative the Iowa Watershed Project is focused on the creation and enhancement of nine wetlands in the Beaver Creek Watershed by using various forms of structural and nonstructural techniques, subsequently these structural and nonstructural improvements have provided a savings in federal, state, and local road/bridge maintenance costs as a result of the wetlands better managing runoff in the watershed.

Techniques Used: A cluster of six wetlands were constructed in the Northeastern Iowa watershed of Beaver Creek. Prior to the Iowa Watersheds Project, three constructed multi-purpose wetlands-type projects were built in the Beaver Creek Watershed between 2006 and 2013. Together, the six Iowa Watersheds Project wetlands and three existing wetlands provide total flood storage of 155.2 acre-feet.

Expected Benefits: Nitrates reduction, flood storage, infrastructure maintenance cost savings, flood damage reduction, aesthetic improvements, recreation, wildlife habitat, livestock watering, erosion control.

Johnson Creek Watershed Highlights

Initiative/Project Title:

Johnson Creek Watershed
Council 2015-2025 Action Plan

Watershed Location:

Oregon

Watershed Size:

33,280 acres

Start-End Dates:

- Planning: 2002-2015
- Implementation: 2002-2015
- Monitoring: 1997-2010

Project Summary:

Current efforts to restore Johnson Creek focus on restoring its natural resource functions. Restoration efforts have been designed to provide improved flood storage, water quality benefits, and increases fish and wildlife habitat by returning some of the natural historic conditions and functions to the watershed.

Techniques Used:

Project techniques included the acquisition of properties containing inundated structures and conservation easements, the design and build of a constructed wetland, streambank stabilization and floodplain reconnection activities, wetland enhancements, wetland protection, removal of fish barriers through culvert modification, mitigation of impervious surface, protection and restoration of riparian vegetation, and property owner education.

Expected Benefits:

Community building, open migration, lower stream temperatures, cleaner water; habitat conservation, and development of an information hub focused on watershed maps, data, reporting and outreach.

Anacostia River Watershed Highlights

Initiative/Project Title:

Anacostia Watershed Restoration

Watershed Location:

Maryland

Watershed Size:

112,640 acres

Start-End Dates:

- Planning: 1987-2006
- Implementation: 2007 – 2025
- Monitoring: 2010 - 2025

Project Summary: Uncontrolled stormwater runoff and untreated trash and sewage are the biggest issues within the Anacostia Watershed: causing bank erosion and sedimentation in streams. Additionally, the watershed has lost approximately 6,500 acres of wetlands, which includes 93% of the original 2,500 acres of tidal wetlands. There are 15 subwatersheds within the broader Anacostia Watershed, and 3,018 candidate restoration projects split between the subwatersheds. Of the 3,018 candidate projects, 1,892 of them fall under the stormwater retrofit category/strategy. Other strategies include wetland creation/restoration, riparian reforestation, invasive management, parkland acquisition, trash reduction, and toxic remediation.

Techniques Used: Restore and recreate wetlands to move filtered water to the river in an ecologically sound manner. Other strategies include: fish blockage removal, riparian reforestation, meadow creation, street trees and invasive management, trash reduction, toxic remediation, parkland acquisition, stormwater retrofits and stream restoration.

Expected Benefits: Enhanced wildlife habitat, cleaner water, reduced trash, savings on infrastructure repairs, local green jobs creation, reduced flash flooding, recreational amenities, aesthetic enhancements, and heat island mitigation.

Lessons Learned:

- Manage the progress expectation of any restoration plan.
- Restoration projects will drop out and new projects will be added.
- NPDES permit requirement will dictate project implementation schedule.
- Multijurisdictional watershed will require collaboration.

Upper St. Johns River Highlights

Initiative/Project Title:

Upper St. Johns River Basin Project

Watershed Location:

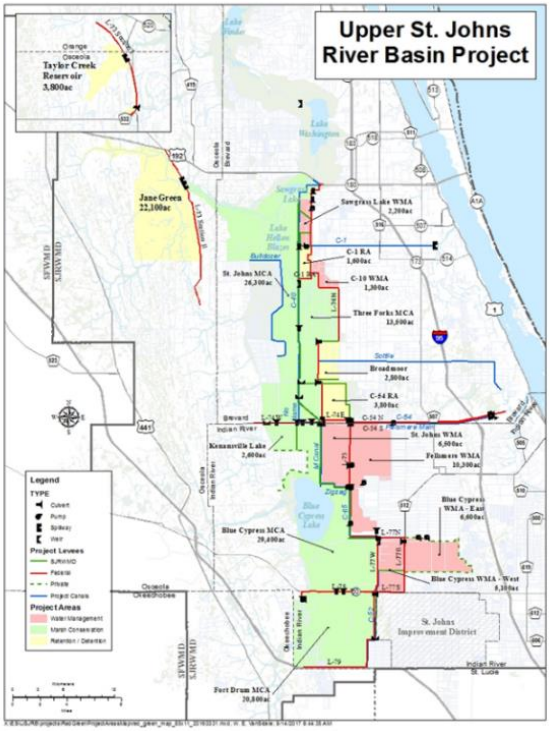
East-Central Florida

Watershed Size:

160,000 acres

Start-End Dates:

- Planning: 1977-1988
- Implementation: 1988-2016
- Monitoring: On-going



Project Summary:

Once, the Upper St. Johns River Basin's headwaters comprised of nearly 400,00 acres of herbaceous marshes and other wetland habitats, but by the mid-70s approximately 62% of the 100-year floodplain had been converted to agricultural land. This development led to ecological degradation, loss of water storage, diminished water quality as a result of nutrient enrichment, decrease in fish and wildlife populations, and exotic/invasive species encroachment.

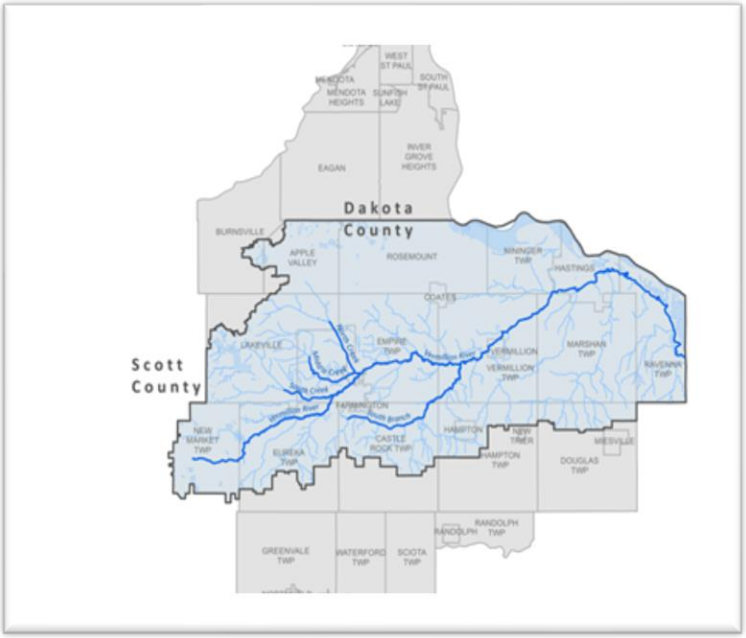
Techniques Used: The St. Johns River Water Management District (District) and US Army Corps of Engineers (ACOE) utilized a "semi-structural" approach in the USJRB project area, and as a result they were able to reclaim and restore over 29,000 hectares of wetlands through floodplain acquisition and the construction of levees, canals, and water control structures.

Expected Benefits: The USJRBP identifies flood protection as the primary goal of the project along with four major environmental objectives: water quality improvement, re-establishment of natural hydrologic patterns, reduction of freshwater discharge to the Indian River Lagoon estuary, and restoration of wetland habitat.

Lessons Learned:

- Detailed and up-to-date elevation data is critical to ensure proper hydrologic functioning.
- Budget money and time into restoration projects to complete contamination assessments and monitoring.
- Engage stakeholders early and often during the process of restoration and come up with creative solutions to allow multiple uses of wetland areas.

Vermillion River Watershed Highlights



Initiative/Project Title:

Vermillion River Watershed Joint Powers Organization (VRWJPO)

Watershed Location:

Minnesota

Watershed Size:

214,400 Acres

Start-End Dates:

- Planning: 2013-2016
- Implementation: 2016 – 2025
- Monitoring: ongoing

Project Summary:

The focus of the VRWJPO is to protect and restore water quality in lakes, streams, and wetlands within the watershed. The quality of the surface water within the watershed is either threatened or impaired, while groundwater quality is also at risk. VRWJPO is implementing or planning to implement approximately 60 projects, split between the 8 highest priority subwatersheds within the larger watershed: these projects will use a combination of restoration, enhancement, and protection techniques.

Expected Benefits:

The resulting benefit of these projects include increased watershed resilience, improved water quality, pollutant filtration and biodegredation, avoided flood/erosion damage, reduced infrastructural costs, and increased recreational value.

Lessons Learned:

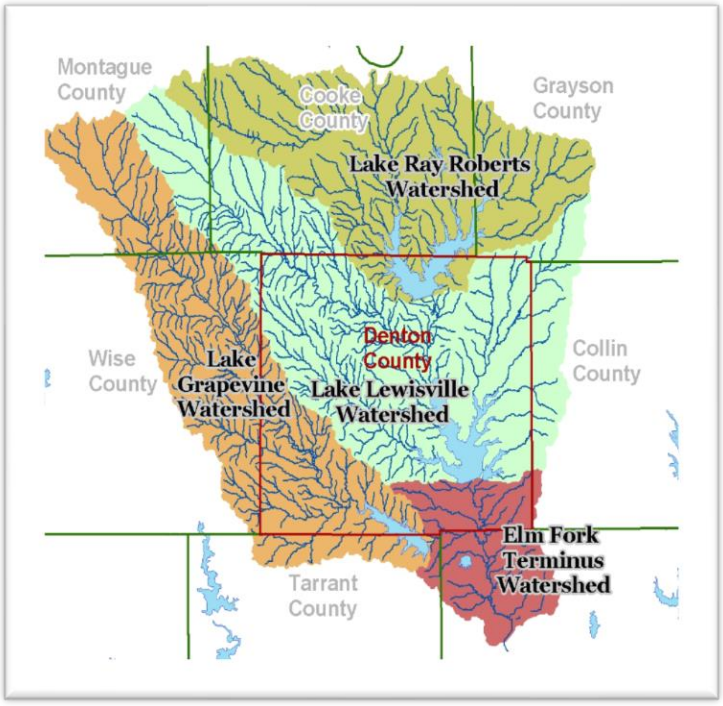
Designing project management to adequately represent all interested parties without becoming cumbersome was critical to the organization and its goals.

Lewisville Lake Watershed Highlights

Initiative/Project Title:

Upper Trinity Regional Water District Watershed Protection Program:

Denton County Green Belt Plan



Watershed Location:

Denton County, Texas

Watershed Size:

619,522 acres

Start-End Dates:

- Planning: April 2015 – July 2017
- Implementation: August 2017 - Present

Project Summary:

The Upper Trinity Regional Water District is a wastewater and wholesale water utility that is focused on preserving and protecting natural resources/features and water quality in the Lewisville Lake Watershed. Using a combination of restoration, enhancement, and protection techniques the UTRWD aims to protect creeks, floodplains, riparian zones, and wetlands by establishing greenbelts, minimizing the use of fertilizers and other chemicals, raising public awareness and education, and by providing conservation easements for landowners (in the form of land trusts). UTRWD distributes treated water to more than 26 cities and utilities, as well as provides a regional Watershed Protection Program aimed towards education and outreach to encourage stakeholders to protect local water quality. The water district also established the Upper Trinity Conservation Trust to acquire and hold conservation easements within the watershed.

Techniques Used: Preservation of existing natural areas, including wetlands, floodplains and riparian lands. Other techniques include: public education, low impact development and green infrastructure, minimization of fertilizers, use of native vegetation, best management practices for reducing pollution and erosion.

Expected Benefits: Improved water quality, habitat protection, reduced pollutants, flood damage reduction, increased property values, reduced water treatment costs, educational opportunities

Lessons Learned: Partnerships and input from a wide range of stakeholders is vital.

Jemez River Watershed Highlights

Initiative/Project Title:

Rio de las Vacas Wetlands Restoration Project

Watershed Location:

New Mexico

Watershed Size:

661,760 acres

Start-End Dates:

October 2005 – October 2008

Project Summary: The Jemez River is significantly impaired due to soil erosion, which is thought to have resulted from a variety of natural and other activities such as grazing, recreation, stream bank modification, removal of riparian vegetation, silviculture, road construction and maintenance, and channel widening. The Rio de las Vacas Wetlands Restoration Project encompasses approximately 40-50 individual projects.

Techniques Used: This project utilizes a combination of restoration, enhancement, and public education to improve wetlands in the target watershed on both public and private lands. This includes restoring almost 2 miles of stream along Rio de las Vacas; reducing non-point source pollution into the streams by modifying and rehabbing campsites located along Rio de las Vacas; reconstructing and maintaining an existing buck and pole fence on the Middle Rio de las Vacas; and restoring the wetlands along the Rio de Las Vacas using bioengineering, planting of native plants, and structural techniques. The plan also identifies promoting awareness of the role beavers play as wetland implementers and the importance of water protection and conservation.

Expected Benefits: Enhanced water quality, increased water retention, and more resilient habitat through increased biodiversity and habitat productivity.

Lessons Learned:

- Time management is very important
- Be prepared to deal with varying levels of interest and understanding from private landowners.
- It was also an important lesson to keep communication open with the Cuba Ranger District, especially Range staff, to address trespass cattle issues.
- The ability to compromise has been our biggest asset in moving forward with this project.

Yakima River Basin Highlights

Initiative/Project Title:

Yakima River Basin Integrated Water Management Plan

Watershed Location:

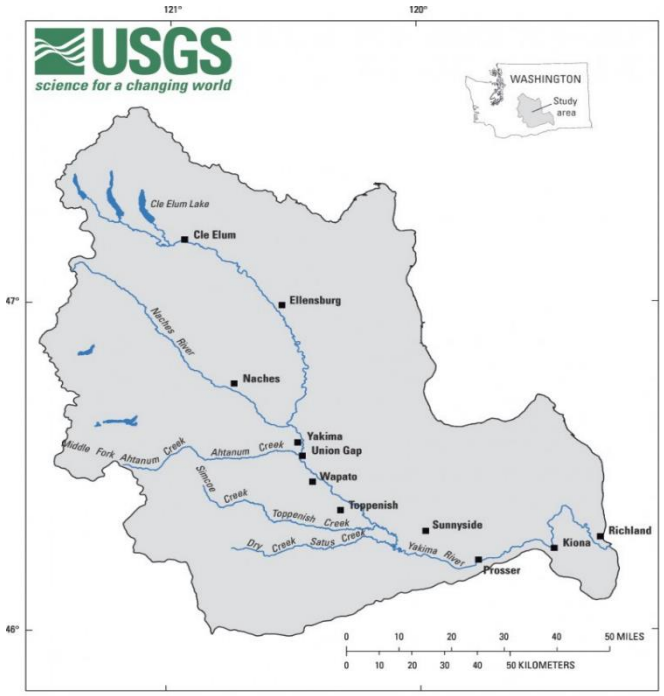
Washington

Watershed Size:

3,936,000 Acres

Start-End Dates:

- Planning: 2009-2013
- Implementation: 2013-2045



Location of the Yakima River Basin

Project Summary:

Drought and a changing climate pose some of the biggest threats to the health of the Yakima River Basin. The Yakima River Basin Integrated Water Management Plan offers a 30-year vision for how to respond to drought, climatic change, water quality issues, and to ensure lands are protected and productive for both the natural and agricultural environments. Currently there are approximately 40 projects being implemented in the river basin, most of which are habitat restoration and water conservation projects. As one of the larger watershed initiatives in *Healthy Wetlands Healthy Watersheds*, the Yakima River Basin supports $4.5 billion in the agriculture/processing industries, in addition to an estimated value of $350 million-$15 billion in ecosystem services, $1.2 billion in outdoor recreational expenditures, as well as unquantifiable cultural and spiritual value of Salmon and Steelhead to the Yakima Nation.

Techniques Used: The Plan utilizes a combination of restoration, enhancement, and protection techniques including; improvement to fish passage and restoration of river and stream habitat, irrigation system updates, institution of a water market, protecting 70,000 acres of private land, and enhanced protection for over 160,000 acres of federal land.

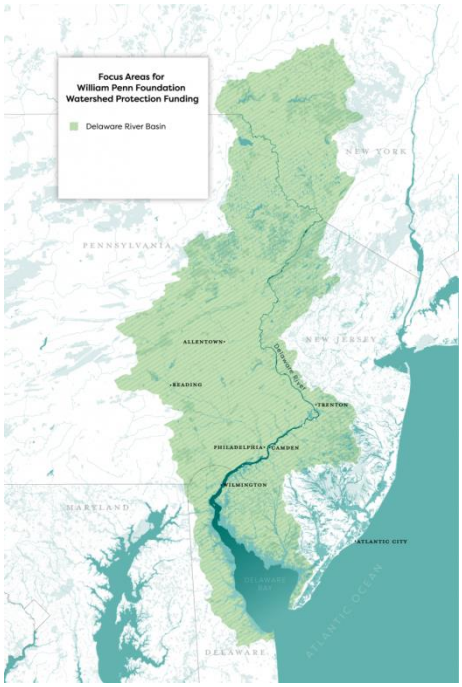
Expected Benefits:

- Improved fish passage and habitat
- Enhanced water conservation
- Increased surface water storage
- Groundwater storage
- Improved water allocation

Delaware River Basin Highlights

Initiative/Project Title:

Delaware River Watershed Initiative



Watershed Location:

Delaware River Basin, located in New York, New Jersey, Pennsylvania, and Delaware

Watershed Size:

8,664,960 acres

Start-End Dates:

- Planning: Not Provided
- Implementation: 2014-Present
- Monitoring: 2014-Present

Project Summary:

The Delaware River Watershed Initiative (DRWI) is a large-scale, collaborative program that is taking action to maintain and improve the quality of aquatic ecosystems within the Delaware River Basin. Of the 8,664,960 acres that make up the Delaware River Basin, wetlands cover approximately 700,000 of those acres. The initiative's components include on-the-ground restoration projects, strategically targeted land protection, public outreach regarding water quality issues, coordination of professional and citizen-based monitoring groups, and sharing data and ideas to measure the changes in aquatic communities over time as a result of these efforts. The Initiative aligns with over 50 organizations to scale up their impact and accelerate the protection of important landscapes, restoration of degraded areas, and adoption of green infrastructure and responsible farming practices. It focuses on 8 targeted areas. Ongoing monitoring occurs at more than 300 locations across the basin.

Techniques Used: Collaborative and shared learning, land protection, stormwater restoration, agricultural restoration, community engagement, and floodplain restoration.

Expected Benefits: Improved water quality; drinking water protection; green, livable communities (including pollution reduction, increased property values and reduced flooding and erosion); and river friendly-farms (farmers making smart choices to reduce fertilizer and pesticide pollution, keep fertile soil on the land, and shade and clean nearby streams).

Appendix E: Watershed Project Datasheets

- **Beaver Creek Watershed**
- **Johnson Creek Watershed**
- **Anacostia Watershed**
- **Upper St. Johns River Basin**
- **Vermillion River Watershed**
- **Lewisville Lake Watershed**
- **Jemez River Watershed**
- **Yakima River Basin**
- **Delaware River Basin**

BEAVER CREEK WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed: Beaver Creek Watershed, a sub-watershed within the Upper Cedar River Watershed as defined by the boundary of eight-digit Hydrologic Unit Code (HUC8) 07080201

Size of watershed (in acres): 11328 acres, 17 square miles

Title of Project/Initiative: Iowa Watershed Project

Setting: (please check all that apply)

__ Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
X Rural (anything outside the urban area)
X Inland
__ Coastal

Need/Challenge Addressed (200 word limit):

In Phase I of the project, the Iowa Flood Center carried out a hydrologic assessment of the Upper Cedar River Watershed (Iowa Flood Center, 2014). The assessment characterized the water cycle of the Upper Cedar River using historical observations. It also investigated trends observed for the Upper Cedar River within the broader context of changes in land use and weather patterns. Researchers implemented a hydrologic model of the Upper Cedar River using the Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) to identify areas in the watershed with high runoff potential and to run simulations to help understand the potential impact of alternative flood mitigation strategies in the watershed. In Phase II of the project, researchers identified a smaller catchment (known as a HUC12 sub-watershed) for development and construction of flood mitigation projects. In collaboration with the Upper Cedar Watershed Management Improvement Authority, they selected the Beaver Creek Watershed where IFC researchers evaluated the flood mitigation performance of proposed projects through monitoring and detailed hydrologic modeling. The team developed small-scale hydrologic simulations for the Beaver Creek Watershed using a more detailed representation of the watershed and flood mitigation strategies than was used in Phase I.

Goals & Objectives (please include ecosystem services/values focused on):

- Maximize soil water holding capacity from precipitation;
- Minimize severe soil erosion and sand deposition during floods;
- Manage water runoff in uplands under saturated soil moisture conditions;
- Reduce and mitigate structural and nonstructural flood damage

Overall Strategy (i.e., what role do wetlands play in your project?)

A cluster of wetlands have been constructed in the Northeastern Iowa watershed of Beaver Creek. This is a 17 mi^2 watershed that outlets to the main branch of the Cedar River near Bassett. There are nine wetlands in total, with seven funded through HUD and two by the USDA (Conservation Reserve Enhancement Program-CREP).

The demonstration projects constructed through the Iowa Watersheds Project provide multiple benefits both on- and off-site. Landowners enjoy the farm wetlands on their property for the aesthetic beauty, recreation, and wildlife attracted to the habitat. In addition, landowners can use the wetlands to water livestock and control erosion on their land. Wetland structures were strategically placed in areas not suitable for farming and upon completion, gave landowners better, easier access to the rest of their farm. Projects create storage on the landscape that reduces downstream flooding, protecting both people and infrastructure. The wetland structures provide significant savings in federal, state, and local road and bridge maintenance costs by managing runoff to reduce and mitigate structural and nonstructural flood damage. Constructed projects serve as demonstration sites to encourage other landowners to adopt similar conservation practices.

Structural: (USACE): Channels, Levee/Wall, Dams, Diversions

Non-structural: (USACE) as it relates to flood risk management can be a set of physical or nonphysical measures used for mitigating loss of life as well as existing and future flood damages. The physical measures adapt to the natural characteristics of the floodplain without adversely affecting or changing those natural flood characteristics. These measures are generally compliant with NFIP and cause no adverse effects to the floodplain, flood stages, velocities, or environment. Non-physical measures are typically applied as management measures in the floodplain - Floodwalls, berms, barriers, and levees with closures, rain gardens, planter boxes, green space, porous pavement (land use, low impact development or green infrastructure), FEMA would consider everything structural outside of planning, building code development, environmental surveys, etc. Consideration for these types of measures include: 1) flood characteristics: depth, velocity, duration, rate of rise, debris/ice flows, wave action and 2) site characteristics: location, soil type, topography, site size, urban/rural

Techniques Used (please check all that apply):

__ Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

X Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

__ Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** University of Iowa IIHR-Hydroscience and Engineering and the Iowa Flood Center

- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Upper Cedar Watershed Management Improvement Authority
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Ducks Unlimited Inc., Floyd County SWCD, Chickasaw County SWCD, Mitchell County SWCD, Iowa Department of Natural Resources, Natural Resources Conservation Service.

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Landowners and local communities

Overview/history (200 word limit):

In 2010, Iowa received $8.8 million from the U.S. Department of Housing and Urban Development (HUD) to assist with ongoing disaster recovery programs following these devastating floods. The Iowa Flood Center (IFC), a unit of the University of Iowa's IIHR—Hydroscience & Engineering, led an effort called the Iowa Watersheds Project. Its goal was to evaluate and implement flood reduction methods in Iowa watersheds. The Upper Cedar Watershed, in collaboration with the Upper Cedar River Watershed Management Improvement Authority, was one of four watersheds (see Figure 1.1) selected to demonstrate a watershed approach for flood risk reduction

Prior to the Iowa Watersheds Project, three constructed multi-purpose wetlands-type projects were built in the Beaver Creek Watershed between 2006 and 2013. The Conservation Reserve Enhancement Program (CREP) funded two of the projects for nutrient reduction purposes. The third wetland is located to the south of the CREP wetlands and drains a smaller area than any of the CREP or Iowa Watersheds Project wetlands. Together, the six Iowa Watersheds Project wetlands and three existing wetlands provide total flood storage of 155.2 acre-feet.

Start and end dates (dates can overlap – estimates are acceptable): 2010-2016

- Planning: Not specified.
- Implementation: Not specified.
- Monitoring: Not specified.

Cost – Financing (estimates are acceptable): Beaver Creek was selected to receive $1.5 million to fund the construction of small flood mitigation projects. It is has been quantified to make a measurable reduction of flooding to a HUC 12 watershed one would need to at least invest in $1.5 million of conservation BMP's

- Planning: Not specified.
- Implementation: Not specified.
- Monitoring: Not specified.
- Continual (are there ongoing maintenance costs that will be required?): Not specified.

Resulting benefits (please list what was measured and how):

- Flood control
- Water quality improvements

- Cost savings in flood damage
- Nitrogen removal
- Demonstration sites to encourage landowners to adopt similar practices

Environmental benefits (e.g. water Ecosystem services/benefits (e.g. water quality improvements, habitat protection or improvement, recreational opportunities, etc.)

The table below illustrates average nitrate concentrations at the two sensors. All the constructed wetlands are upstream of the Colwell sensor.

Nitrate-N mg/L		
Year	Bassett (DS)	Colwell (US)
2014	10.1	9.0
2015	9.2	6.2
2016	10.9	11.4
2017	8.5	6.2
2018	9.3	10.2
AVG	9.6	8.4

During the summer of 2017, two IIHR students extensively sampled the wetlands. Inlet and outlet samples were collected on eight days, June-August. These results are shown below. Overall, nitrate concentrations declined 60.6% in the wetlands.

Site	Inlet NO3-N (mg/L)	Outlet NO3-N (mg/L)
1	16.5	4.3
2	5.8	3.0
3	7.2	3.1
4	14.5	6.5
5	14.7	2.0
6	12.2	7.1
Floyd	13.1	7.0
Wohlers	9.2	3.7
Average	11.6	4.6

Monitoring: In the spring of 2014, researchers installed instrumentation throughout the Beaver Creek Watershed to monitor water quantity and water quality. The Iowa Flood Center deployed sensors to measure hydrologic variables, such as stream stage and rainfall/soil moisture, and IIHR— Hydroscience & Engineering led the water quality monitoring. The instrumentation includes three rain gauge and soil moisture (RGSM) platforms, three stage sensors, six shallow groundwater wells, and two water quality sensors. Each monitoring system consists of an IIHR—Hydroscience & Engineering developed

datalogger, battery, solar panel, and cellular modem. Data were collected, transmitted, and ingested into servers at the University of Iowa on a 15-minute schedule.

The Iowa Flood Center's Iowa Flood Information System (IFIS) online suite of tools provides real time information on watersheds, precipitation, and stream levels for more than 1,000 Iowa communities. Data collected from the rain gauge and soil moisture platforms, shallow groundwater wells, and stream sensors deployed in the Beaver Creek Watershed can be accessed at http://ifis.iowafloodcenter.org/ifis/app. IIHR—Hydroscience & Engineering's Iowa Water-Quality Information System (Iowa WQIS) online tool is built on the same user-friendly Google Maps interface as IFIS, which was developed by the IFC. Iowa WQIS integrates data gathered by IIHR and the U.S. Geological Survey (USGS) and allows users to track water-quality conditions in real-time. Water-quality data for Beaver Creek can be accessed from the site at http://iwqis.iowawis.org/app. The Iowa Flood Information System (IFIS) and the Iowa Water-Quality Information System (Iowa WQIS) provide extensive and critical information needed by scientists, policy-makers, and other Iowans to make science-based decisions that will help us accomplish Iowa's water-quality objectives

In 2015, six wetlands were built in the Beaver Creek Watershed through the Iowa Watersheds Project. The wetlands are designed to serve two purposes: flood mitigation and nitrogen removal. The six wetlands provide a total flood storage of 90.9 acre-feet. The total drainage area regulated by these wetlands is 1,196 acres, or about 10.6% of the Beaver Creek Watershed. (Overall, the flood storage volume of the wetlands is equal to 0.91 inches of runoff from their upstream drainage areas.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):
The wetland structures provide significant savings in federal, state, and local road and bridge maintenance costs by managing runoff to reduce and mitigate structural and nonstructural flood damage. Constructed projects serve as demonstration sites to encourage other landowners to adopt similar conservation practices.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
The demonstration projects constructed through the Iowa Watersheds Project provide multiple benefits both on- and off-site. Landowners enjoy the farm wetlands on their property for the aesthetic beauty, recreation, and wildlife attracted to the habitat. In addition, landowners can use the wetlands to water livestock and control erosion on their land. Wetland structures were strategically placed in areas not suitable for farming and upon completion, gave landowners better, easier access to the rest of their farm. Projects create storage on the landscape that reduces downstream flooding, protecting both people and infrastructure.

Other: Information not provided.

Are benefits based on actual measures or did you use a model to predict benefits? Information not provided.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response) No

If you do not have any data currently available in regard to benefits, how do you plan to measure them? Information not provided.

Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe): Information not provided.

Lessons Learned: Information not provided.

Do you have any images or photos to share?

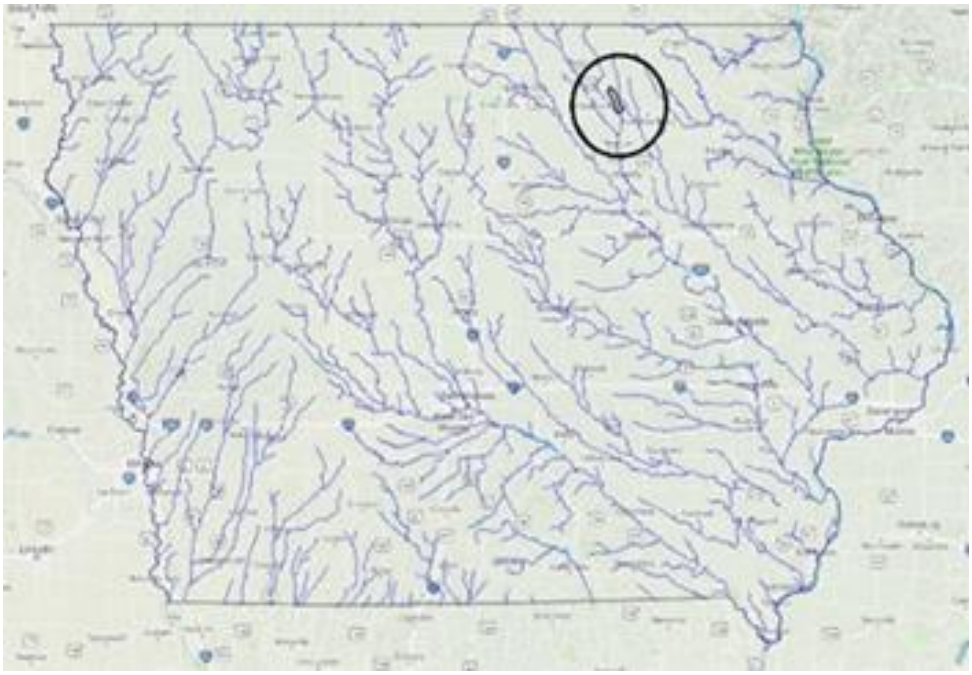


Figure 1: Location of the Beaver Creek Watershed

Figure 2: Wetland Locations

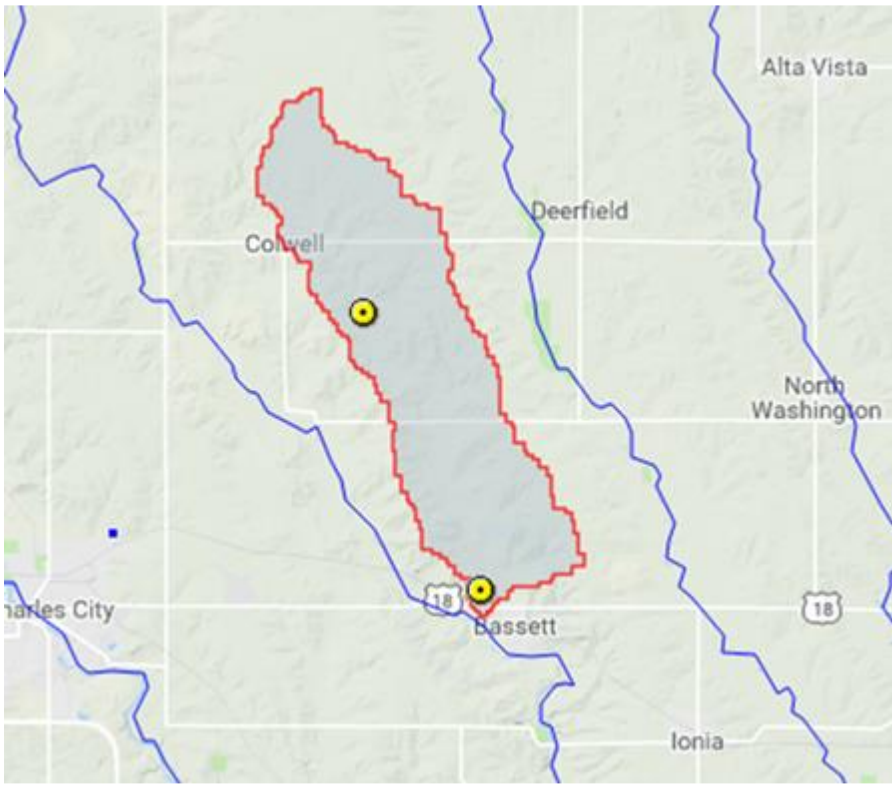


Figure 3: Water quality sensor locations in Beaver Creek

FMI (please include contact name, organization, website, phone number and/or email address):

Beaver Creek Watershed Management Authority

- Bob Rice - Director of Polk County Public Works, 515-286-3705, Robert.Rice@polkcountyiowa.gov
- Jennifer Welch - Polk County Soil and Water Conservation District, 515-964-1883x3, Jennifer.Welch@ia.nacdnet.net

JOHNSON CREEK WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed: Johnson Creek Watershed, Oregon

Size of watershed (in acres): 33280 acres, 52 square miles

Title of Project/Initiative: Johnson Creek Watershed Council 2015-2025 Action Plan
(with various ongoing projects within the overall initiative)

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
- X Rural (anything outside the urban area)
- X Inland
- __ Coastal

Need/Challenge Addressed (200 word limit):
Johnson Creek originates near Boring, Oregon and runs 26 miles west through six jurisdictions before draining into the Willamette River in Milwaukie, Oregon. The Johnson Creek watershed covers an area of 54 square miles, much of which is highly urbanized. 38% of the watershed is within the City of Portland.

The Johnson Creek Watershed Council was established in 1995 by community members committed to restoring Johnson Creek. Their mission is to promote restoration and stewardship of a healthy Johnson Creek Watershed through sound science and community engagement. Watershed Councils are grassroots community groups comprised of citizens who want to help protect, restore and enhance the local watershed where they live, work, and play. They are locally organized, voluntary, non-regulatory organizations, and are intended to be broadly representative of the stakeholders in their respective areas.

Current efforts to restore Johnson Creek focus on restoring its natural resource functions. This type of restoration provides flood storage, water quality benefits, and increases fish and wildlife habitat by returning some of the natural historic conditions and functions to the watershed

Goals & Objectives (please include ecosystem services/values focused on):

- Build community amongst 180,000 people living within the watershed
- Open migration for fish/aquatic wildlife
- Lower stream temperature
- Water quality
- Habitat Conservation
- Information hub/information sharing

Overall Strategy (i.e., what role do wetlands play in your project?)

- Build community: through outreach, volunteer, environmental education, citizen science, etc.
- Open migration: removal of 18 highest priority fish passage barriers, enhance aquatic habitat and floodplains, fish spawning survey

- Cool stream temperatures: through riparian reforestation, in-line ponds, thermal refugia, preserve existing riparian forests
- Cleaner Water: map surface water connected areas and stormwater infrastructure at the watershed-scale, identify highest priority regions in the watershed, promote conservation district, toxic waste collection, encourage sewer hookups, construct demonstration projects
- Habitat conservation: Johnson Creek Acquisition Strategy, convene with landowners & stakeholders, advocate for local/regional land use planning and development backed by wetland science
- Information hub: provide clearinghouse for monitoring and data maps, improve restoration project tracking, engage schools and non-profits in monitoring, fill data gaps, report on watershed health every ten years, etc.

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

X Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** Bureau of Environmental Services, Portland Oregon; Johnson Creek Watershed Council
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Six local jurisdictions are located within the Johnson Creek watershed. These include: The cities of Portland, Gresham, Milwaukie, Happy Valley; Multnomah and Clackamas Counties
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** We also work closely with private landowners, businesses, academics and other non-profits and "friends-of" groups. Nonprofit partners include Friends of Trees, SOLVE, and Depave among others.

  The Inter-Jurisdictional Committee (IJC) is a collaborative group of scientists from the numerous agencies that operate within the Johnson Creek Watershed that serve as the Council's technical advisory committee. They meet monthly to collaborate on issues of watershed health and restoration, keeping each other updated on projects, sharing results, and strategizing for the future. Participating agencies include the Johnson Creek Watershed Council; Multnomah and Clackamas Counties; the Cities of Gresham, Portland, Milwaukie, and Happy Valley; the U.S.

Geological Survey (USGS); Oregon Department of Agriculture; and the East Multnomah Soil and Water Conservation District (EMSWCD). Metro is also an ad hoc member of the group.

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Watershed residents, schools, businesses, environmental organizations, and state and federal resource and regulatory agencies.

Overview/history (200 word limit):

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe.

- Johnson Creek-Cedar Crossing Restoration
- Errol Heights Street Improvement Project
- Luther Road Habitat Restoration Project
- Foster Floodplain Natural Area
- Crystal Springs Creek Restoration
- Errol Creek Confluence Project
- East Powell Butte Restoration Project
- Brookside Wetland Project
- Tideman Johnson Park Restoration Project
- Kelley Creek Confluence Project
- Willing Seller Program

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness.
As of 2016 the Council, jurisdictional partners, private landowners, and other non-profits have implemented 132 restoration projects throughout the Johnson Creek Watershed. An online catalog of restoration projects enables ongoing monitoring of tree growth and maintenance needs and connects students and tours with project sites. It also aids research into the effects of different restoration techniques on water quality, wildlife, or rea estate values. Information about projects in the watershed and their effectiveness can also be found at this link: Johnson Creek Restoration Projects Effectiveness Monitoring

Start and end dates (dates can overlap – estimates are acceptable):

- Planning: 2002-2015
- Implementation: 2002-2015
- Monitoring: 1997-2010

Cost – Financing (estimates are acceptable): Based on Johnson Creek Restoration Plan (2001)

- **Planning:** Information not provided.
- **Implementation:**
  - Acquire properties containing inundated structure: Property in Milwaukie Industrial District = $1,000,000 per acre. Property in jurisdiction of the cities of Portland and Gresham = $145,000 per acre Property in jurisdiction east of Gresham = $45,000 per acre

- Design and build constructed wetland: Property acquisition as described above $10 per cubic yard of material removed $30,000 an acre for wetland grading and vegetation
- Design enhanced wetland: $25,000 an acre for wetland grading and vegetation
- Implement stream bank stabilization and floodplain reconnection: $10 per cubic yard of material removed $10,000 per acre for general riparian planting
- Protect Johnson Creek tributaries: $10,000 per acre for general riparian planting
- Remove fish barriers (culverts): $40,000 per culvert modification
- Increase in-stream complexity: $100 per linear foot of creek channel
- Mitigate impervious surface: $20,000 per acre of impervious surface
- Educate property owners adjacent and near Johnson Creek: $15,000 per property
- Protect and restore wildlife corridors: $10,000 per acre for general riparian planting
- Protect and restore riparian vegetation: $10,000 per acre for general riparian planting
- Acquire conservation easements: $0.27 per square foot, applied to 10% of property size of properties identified as possible work with along Johnson Creek

- **Monitoring:** Information not provided.
  Continual (are there ongoing maintenance costs that will be required?): Information not provided.

Funding:
The Johnson Creek Watershed Council is a 501(c)3 nonprofit organization, although not all Watershed Councils are nonprofit organizations. A portion of our funding comes from the Oregon Watershed Enhancement Board. The Oregon Watershed Enhancement Board is a small state agency created by the legislature and funded principally with State Lottery funds and federal Pacific Salmon and Coastal Recovery funds to implement the programs and policies of the Oregon Plan. The Oregon Plan is a comprehensive program for the protection and recovery of species and for the restoration of watersheds throughout this state. The Oregon Plan combines the regulatory and other actions of state and federal agencies and local governments with voluntary restoration by private landowners and others. To learn more about the other Watershed Councils in Oregon, see the Network of Oregon Watershed Councils.

Resulting benefits (please list what was measured and how:

- Flood control
- Water quality improvements
- Hydrological conditions
- Wetland restoration
- Biodiversity/productivity
- Public access, recreation, awareness

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.):
Over the past twenty years, major efforts have begun reconnecting Johnson Creek to its floodplain and protecting and restoring important fish and wildlife habitat. As a result, hundreds of streamside acres have been reforested with native shrubs and trees, over 4,600 acres of parks and natural areas have been established in the watershed, and Johnson Creek is now one of the few urban streams in our region where salmon spawn, year after year. Successful revegetation has taken place at each restoration site.

Cumulatively, over 29,000 trees, 70,000 shrubs, 21,000 wetland plants and 1,200 pounds of grass and wildflower seed has been planted providing bank protection and stabilization.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.): Information not provided.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
A 21-mile bicycle and pedestrian path now follows the creek for much of its length leading to increased recreational use. Community engagement efforts have led to increased stewardship and advocacy by residents. In 2014, over 1,300 people volunteered time with the Council to improve the Watershed through weed control, planting parties, garbage clean-ups, citizen science, and other fun and educational events.

Other: Information not provided.

Are benefits based on actual measures or did you use a model to predict benefits?
The Inter-Jurisdictional Committee (IJC) has developed a monitoring strategy to detect changes in watershed health overtime – one based on coordination and data sharing across the basin. Not only does monitoring allow us to demonstrate changes in watershed health over time, it also provides information for future project design and priority setting and provides assurance to funders that their investments are being tracked. There is currently a significant investment in monitoring by various entities within the basin. However, each program is intended to meet a specific objective and is focused on a specific geographical area. Based on our monitoring strategy, the Council and the IJC synthesize this data at the basin level to assess conditions and track changes in watershed health.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response): Information not provided.

If you do not have any data currently available in regard to benefits, how do you plan to measure them? Information not provided.

Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe): Information not provided.

- 1995 – Oregon House Bill 3441 passed, providing guidance in establishing watershed councils. According to the state statute, a watershed council is "…a voluntary local organization designated by a local government group convened by a county governing body to address the goal of sustaining natural resource and watershed protection and enhancement within a watershed." One of the important points of that definition is that designating a watershed council is a local government decision for which no state approval is required. It is also important to note that,

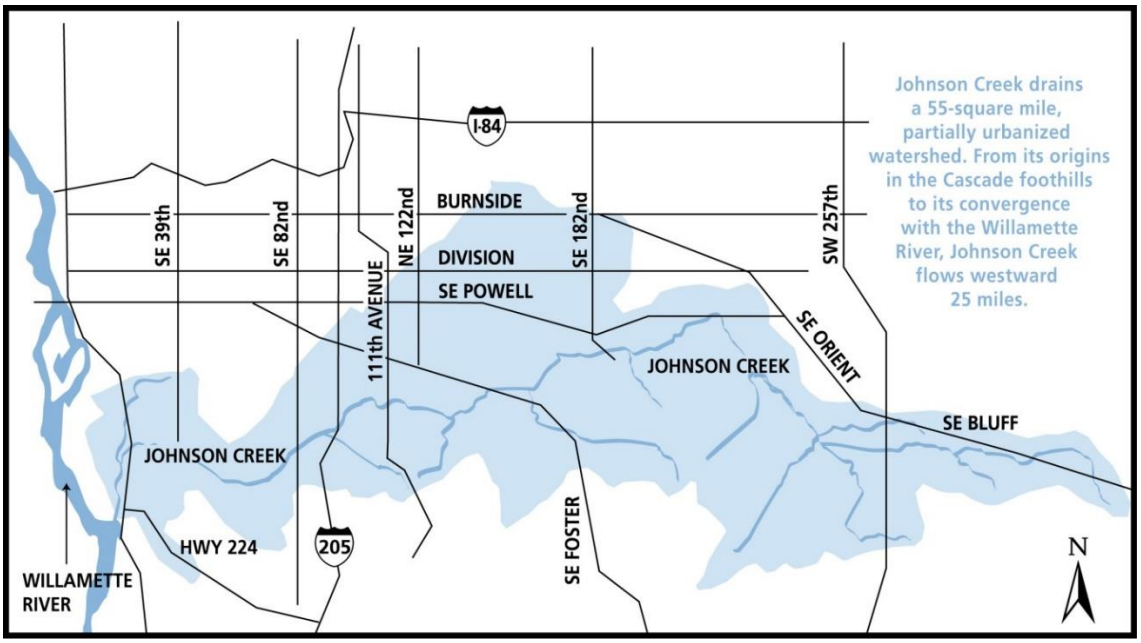
though they are designated by a local government entity, watershed councils are not government entities.

- 1997 – The Oregon Plan for Watersheds and Salmon placed into statute by the Oregon State Legislature.
- In 1990, Gresham voters passed a $10.25 million bond measure to acquire 152 acres of forest in the Watershed.
- In 1995 & 2006, voters approved Metro bond measures to purchase natural areas, protecting 350 acres in the Johnson Creek Watershed.
- The City of Portland has conserved 350 acres of land, particularly in floodplain areas, through the Willing Seller Program and other nativities.
- New land use planning and policies protect areas, trees, and water quality. Metro's Title 3 and Title 13 zoning regulations now protect streams and wetlands from development.

Lessons Learned:
Long-term monitoring and recovery of a watershed that is managed by five cities, two counties, Metro, and multiple state and federal agencies, requires intense basin-wide coordination. Strong relationships with our partners have led to greater collaboration and integration of our planning and monitoring efforts.

Our understanding of monitoring needs and protocol has increased greatly in the 10+ years since we began the Johnson Creek Restoration Program. As a result, we base monitoring plans on project design criteria and ideally, develop a monitoring plan as part of the design process. Project design engineers have the best sense of where a project is most vulnerable to failure and what elements are most critical for success. It is important that the monitoring methodology is cost-effective, repeatable, and can be implemented by bureau staff.

Do you have any images or photos to share?



Johnson Creek watershed map

Johnson Creek Pedestrian Bridge

Restored Johnson Creek Bank in East Lents

FMI (please include contact name, organization, website, phone number and/or email address):

Lisa Huntington
Bureau of Environmental Services
503-823-5334
lisa.huntington@portlandoregon.gov

Noah Jenkins
Riparian Program Manager
503-652-7477
noah@jcwc.org

Chuck Lobdell
Restoration Project Manager
503-652-7477
chuck@jcwc.org

Websites & Documents

- Johnson Creek Watershed Council 2015-2025 Action Plan
- Johnson Creek Restoration Projects Effectiveness Monitoring
- Johnson Creek Watershed Council Website
- Johnson Creek Watershed Action Plan: An Adaptive Approach

ANACOSTIA WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed: Anacostia Watershed

Size of watershed (in acres): 112,640 acres

Title of Project/Initiative: Anacostia Watershed Restoration

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
- __ Rural (anything outside the urban area)
- X Inland
- __ Coastal

Need/Challenge Addressed (200 word limit):

The primary stressor within the Anacostia watershed is pollution from uncontrolled stormwater runoff, which erodes stream banks and washes over impervious—often contaminated—surfaces such as roofs, roads, and parking lots. The runoff carries fertilizers, animal wastes, pollutants from cars and trucks, and other stormwater pollutants that contain phosphorus and nitrogen—nutrients that cause excessive growth of algae and nuisance plants, depleting oxygen that is needed to sustain aquatic life in streams and the river. Stormwater also brings trash into the watershed—about 817 tons each year. This uncontrolled and untreated stormwater flows through the watershed into the river and its tributaries at volumes and velocities that cause stream-bank erosion and sedimentation. The Anacostia watershed contains 10 times the sediments of any other Chesapeake Bay tributary. About 85 percent of this sediment is trapped because of the river's sluggish flow, remaining in the water for an average of 23 to 28 days. Another problem is toxic pollutants and other chemicals trapped in the unhealthy volume of sediment. This contamination affects burrowing organisms that live in the sediment and fish that feed on them.

Goals & Objectives (please include ecosystem services/values focused on):

1. Dramatically reduce the amount of pollution flowing into the Anacostia River and watershed.
2. Protect and restore the watershed's ecological integrity— improving water quality and supporting wildlife habitat and recreational amenities
3. Improve fish passage to enable fish to migrate and spawn in the river and its tributaries.
4. Increase wetland acreage to support water filtration and the proliferation of plants and animals.
5. Expand forest cover.
6. Increase public and private participation in understanding and advocating for the health of the watershed and river.

Overall Strategy (i.e., what role do wetlands play in your project?)

Wetland creation and restoration. The watershed has lost 6,500 acres of wetlands, including 93 percent of the original 2,500 acres of tidal wetlands. The remaining wetlands are degraded and fragmented, thereby diminishing essential functions such as reducing flooding, protecting water quality, and providing

habitat for plants and animals. The plan's projects will restore and recreate wetlands to move filtered water to the river in an ecologically sound manner.

Other strategies include: fish blockage removal, riparian reforestation, meadow creation, street trees, and invasive management, trash reduction, toxic remediation, parkland acquisition, stormwater retrofits and stream restoration.

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

X Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** County Executive, Montgomery County; County Executive, Prince George's County; Mayor, District of Columbia; Governor, State of Maryland; Regional Administrator, EPA Region III; District Engineer, USACE Baltimore District; DC Dept. of Energy and Environment; Mont. Co. Dept. of Environmental Protection; PG Co. Dept. of the Environment; MDE; MDNR; NOAA; NPS;
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Anacostia Watershed Management Committee –EPA; USACE; NOAA; NPS; GSA; PG Co.; Mont. Co.; DOEE; PGDoE; MCDEP; MDE; MDNR; M-NCPPC; MSHA; City of Takoma Park, University of MD, Beltsville Agricultural Research Center (BARC)
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Anacostia Watershed Community Advisory Committee; Anacostia RiverKeeper; Anacostia Watershed Society; Alice Ferguson Foundation; Audubon Naturalist Society; Casey Trees;DC Appleseed; Earth Conservation Corps; Friends of the Earth; Montgomery Stormwater Partners

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Organizations listed above, as well as over 800,000 individuals who live within the watershed

Overview/history (200 word limit):

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe.

There are 15 subwatersheds that are within the broader Anacostia Watershed. There are well over 3,018 candidate restoration projects that include the strategies listed above: Stormwater retrofits, stream restoration, wetland creation/restoration, fish blockage removal/modification, riparian reforestation, meadow creation, street tree and invasive management, trash reduction, toxic remediation, and parkland acquisition. 1,892 of the 3018 candidate projects fall under the stormwater retrofit category/strategy.

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness.
Past and Current progress of projects can be found by following the link provided below: Restoration Progress Dashboard and mapping services.

Start and end dates (dates can overlap – estimates are acceptable):

- Planning: 1987-2006
- Implementation: 2007-Present Day (?) – through 2025
- Monitoring: 2010-2016(?)- through 2025

Cost – Financing (estimates are acceptable):

- **Planning: & Implementation:** $1,728,739,290, (based on the FY09 Dollar value) between 8 types of projects (Stormwater retrofits, stream restoration, wetland creation/restoration, fish blockage removal/modification, riparian reforestation, meadow creation, street tree and invasive management, trash reduction, toxic remediation, and parkland acquisition)
- **Monitoring:** In 2009, core monitoring to track goal efforts was estimated to be 2 to 3 million dollars, annually.
- **Continual (are there ongoing maintenance costs that will be required**?): Undetermined.

Resulting benefits (please list what was measured and how):

- Flood control
- Water quality improvements
- Hydrologic conditions
- Wetland restoration
- Biodiversity/productivity
- Public access, recreation, awareness
- Cost savings on infrastructure repairs, hiring local contractors reinvesting tax $ locally
- Habitat, Stormwater mgt, Reducing pollutants, Aesthetic improvements, property value, quality of life, reduced energy costs (cooling)

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.): Enhanced wildlife habitat: The plan will benefit wildlife and fish in the watershed by improving water quality and preserving native vegetation. Cleaner water: Stormwater management controls will improve water quality by reducing the pollutants in streams coursing through the watershed near homes and businesses. Reduced trash: The plan identifies opportunities to eliminate debris through trash traps, street sweeping, and outreach and education.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.): Savings on infrastructure repairs: Uncontrolled stormwater damages sewer lines and undermines streets and bridges as well. For example, WSSC spends up to $45 million a year for repairs. Improved stormwater management will reduce these maintenance costs. Reduced flash flooding: Flooding occurs when stormwater has nowhere to go. Projects that include storage and ESD will help reduce the backups that flood streets, homes, and businesses. Green jobs: Most of the plan's projects require hiring local contractors for design, construction, and maintenance, reinvesting tax dollars in the watershed's economies.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements): Recreational amenities: The plan's projects will expand and restore parkland, forests, streams, and other areas for hiking, boating, and enjoying the natural world. Aesthetic enhancements: Environmental site design creates appealing streetscapes, rain gardens, and other attractive features in urban and suburban landscapes that increase property values and the quality of life.

Other: Heat island mitigation: The addition of shade trees, green roofs, and other features serves to insulate buildings, reducing energy use, mitigating climate change, and providing health benefits through cooling.

Are benefits based on actual measures or did you use a model to predict benefits? Environmental benefits are based on a combination of monitoring and modeling. Financial or Economic Impact Benefits based on the redevelopment efforts along the tidal river areas.

- **Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response):** No

- **If you do not have any data currently available in regard to benefits, how do you plan to measure them?** No information provided.

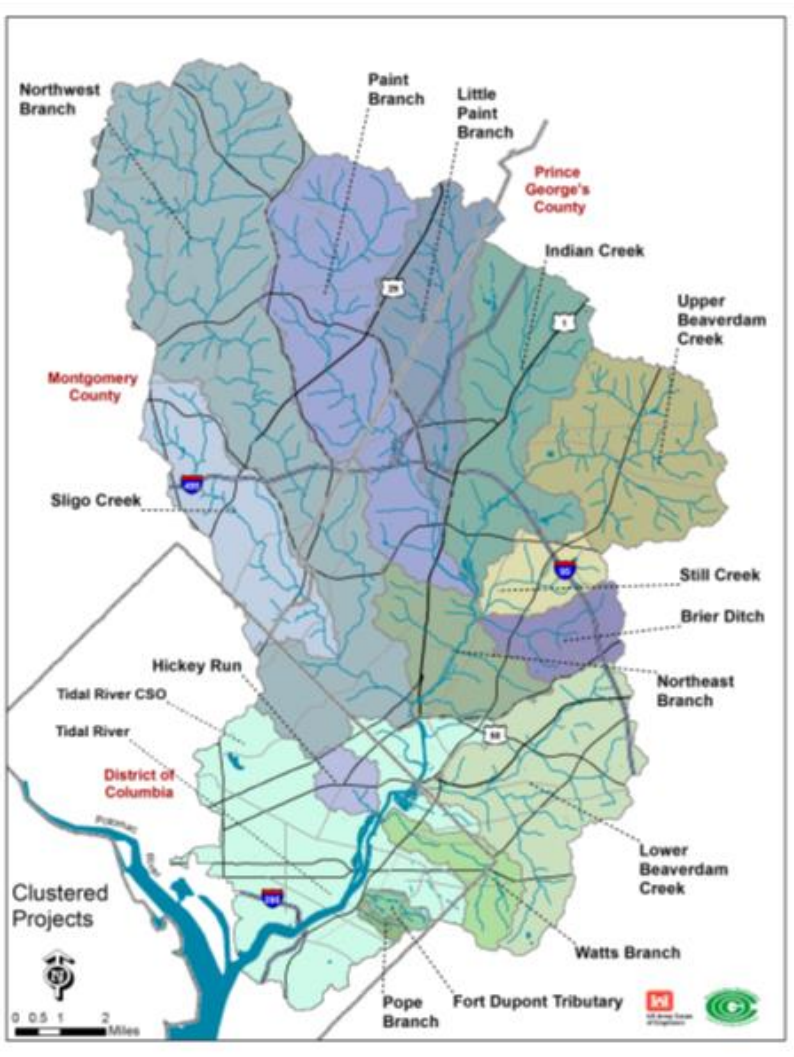
Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? If so, please describe:

Executive Order 13508 Chesapeake Bay Protection and Restoration Section 203 Final Coordinated Implementation Strategy

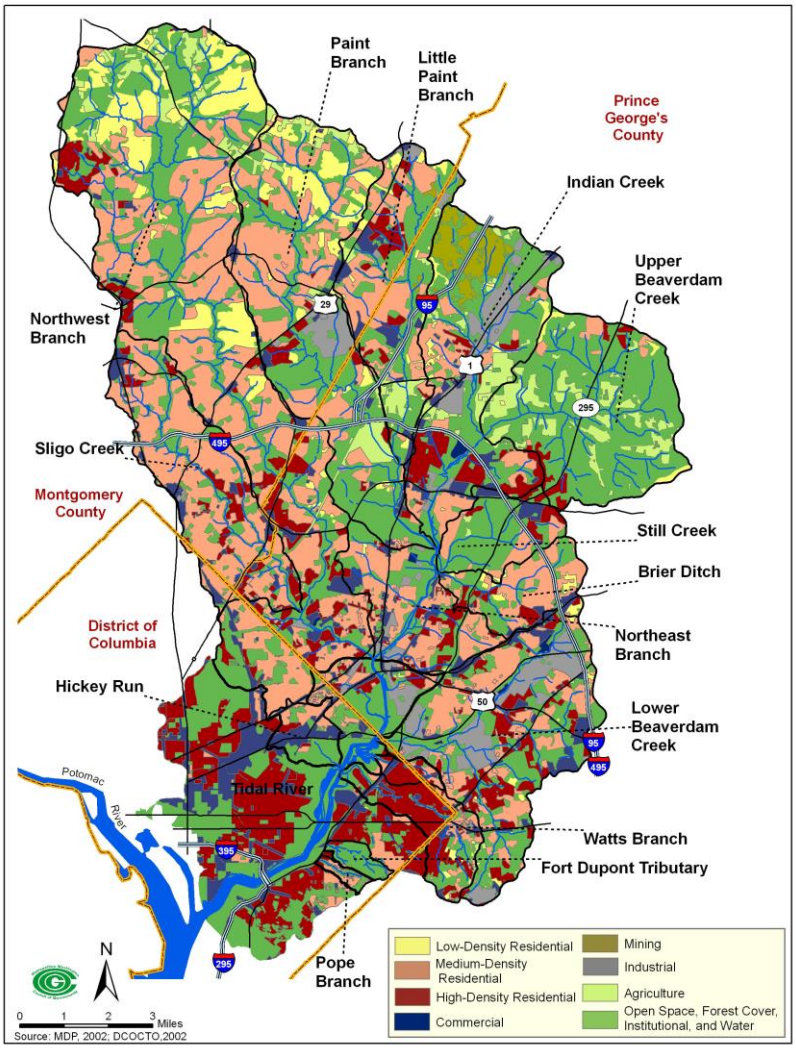
Lessons Learned:

- Manage the progress expectation of any restoration plan;
- Candidate restoration projects is not the final list; projects will drop out and new projects will be added;
- NPDES permit requirement will dictate project implementation schedule.
- Multijurisdictional watershed will require collaboration.

Do you have any images or photos to share?



Anacostia Watershed and its Subwatersheds



Land use within the Anacostia Watershed

FMI (please include contact name, organization, website, phone number and/or email address):
Metropolitan Washington Council of Governments
Anacostia Watershed Restoration Partnership
www.anacostia.net
anacostia@mwcog.org
Phone: 202-962-3200

Important Links:

http://www.anacostia.net/Restoration_Plan/download/Restoration_Overview.pdf
http://www.anacostia.net/Restoration_Plan/download/Anacostia-Report-Web-Quality.pdf

UPPER ST. JOHN'S RIVER BASIN PROJECT INVENTORY DATA SHEET

Name and location of watershed:
Upper St. Johns River Basin Project, east-central Florida

Size of watershed (in acres):
250 square miles = 160,000 acres

Title of Project/Initiative:
Upper St. Johns River Basin Project (USJRBP)

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
- X Rural (anything outside the urban area)
- X Inland
- _ Coastal

Need/Challenge Addressed (200-word limit):
The Upper St. Johns River Basin (USJRB) headwaters originally encompassed nearly 400,000 acres, characterized by a mosaic of habitats dominated by herbaceous marshes. However, beginning in the early 1900s, the historic floodplain was diked and drained and by the 1970s, 62% of the 100-year floodplain had been converted to agriculture. Agricultural development led to widespread ecological degradation of the USJRB, including loss of water storage resulting in increased flooding, diminished water quality due to nutrient enrichment, disruption of the natural hydrologic and fire regimes, decreases in fish and wildlife populations, and exotic and invasive species encroachment.

To provide enhanced flood protection and reverse environmental degradation, the St. Johns River Water Management District (District) partnered with the U.S. Army Corps of Engineers (ACOE) to reclaim and restore the historic floodplain using a "semi-structural" approach in the USJRB Project area (USJRBP), whereby wetland storage capacity was expanded through extensive floodplain acquisition and construction of numerous levees, canals, and water control structures to manage water levels. In total, the District has reclaimed and restored over 29,000 hectares of wetlands.

Goals & Objectives (please include ecosystem services/values focused on):
The USJRBP addresses the four Core Missions of the District: Flood Protection, Water Quality, Water Supply, and Natural Systems. Additionally, there are four major *environmental objectives* of the USJRBP:

1) water quality improvement,
2) re-establishment of natural hydrologic patterns,
3) reduction of freshwater discharge to the Indian River Lagoon estuary, and
4) restoration of wetland habitat.

Overall Strategy (i.e., what role do wetlands play in your project?)

Primary Objective – Provide Flood Protection - The USJRBP is designed to use the natural flood storage capabilities of floodplain wetlands and thus minimize the need for highly structural flood control

solutions. Large areas of floodplain wetland, termed Marsh Conservation Areas (MCAs), provide natural flood storage and the slow release of water downstream through water control structures. This approach has minimized the need for more extensive flood control levees, as well as, provided an opportunity for the return of a more natural hydrologic regime and restoration of wetlands.

Environmental Objective 1 - Water quality improvement – Water Management Areas (WMAs) within the USJRBP have been designed to segregate and improve water quality of agricultural and urban drainage coming into the basin. These areas include both wetlands and open water habitat that capture and treat runoff from surrounding citrus groves and livestock pastures. This runoff water is reused for farm irrigation and freeze protection. After water is treated in these areas, it is released into more pristine MCAs. Perhaps the best-known water management area, the St. Johns Water Management Area (known colloquially as the Stick Marsh), is highly utilized by anglers because of its productive sport fishery. The other WMAs are the Blue Cypress, Fellsmere and Sawgrass Lake WMAs.

Environmental Objective 2 – Re-establishment of natural hydrologic patterns - The USJRBP includes the design and construction of water control structures that govern water flow from one project area to another. These structures are operated to provide necessary flood protection, as well as, restore natural hydrologic patterns. During times of high water, large water control structures (gates) are operated to provide flood protection and allow the slow release of floodwaters downstream. However, when water level is below flood control stage, smaller structures (weirs and culverts) are operated to provide environmental benefits allowing continual downstream flow. To ensure a more natural hydrologic regime, District scientists developed a set of environmental hydrologic criteria (EHC) which must be met in each project area. The EHC address hydrologic characteristics which are significant determinants of the ecological functioning of floodplain wetlands. For example, the frequency of inundation is important in the wetland function of carbon storage; and timing of water level fluctuations is important to breeding cycles of wetland fauna. Hydrologic modelling is used to develop operating schedules for the water control structures which meet these criteria, providing a direct quantifiable method for assessing the long-term environmental performance of each project area.

Environmental Objective 3 – Reduction of freshwater discharge to Indian River Lagoon (IRL) – The diversion of excess freshwater to estuaries, like the IRL, has been shown to negatively impact the ecology of the estuary. By providing flood protection through floodplain storage and the construction of flood control structures, flood waters are being re-diverted back to the USJRBP, rather than being released to the ocean via the nearby IRL. Under the current project design, discharge of flood waters to the IRL, through the largest of these diversion canals (C-54), is expected to occur only with the 1 in 25-year flood.

Environmental Objective 4 - Restoration of wetland habitat - Restoration areas in the USJRB are former agricultural lands (citrus groves, cattle pastures or row crops) that are restored to wetlands that provide water storage, water quality improvement, wildlife habitat, and recreational opportunities. While some restoration areas were purchased, restored, and hydrologically reconnected to the floodplain (Sixmile Creek Marsh Restoration Area), others are operated independently leaving levee systems and water control structures intact (Broadmoor Marsh Restoration Area). Some areas are managed by other agencies to enhance wildlife habitat, such as the T.M. Goodwin Waterfowl Management Area. Restoration activities on these properties have included removal of berms, culverts, pumps, external

levees and filling or plugging ditches to restore the proper hydrologic regime to support wetland habitats. Some small areas were planted with desirable native plants and some land-forming was conducted to create a structurally diverse habitat. However, the primary approach was to restore wetland hydrology and allow the flora and fauna to develop into a long-term, sustainable ecosystem.

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

__ Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** St. Johns River Water Management District, U.S. Army Corps of Engineers (ACOE).
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Florida Fish and Wildlife Conservation Commission (FFWCC), U.S. Geological Survey (USGS), Florida Department of Environmental Protection (FDEP), U.S. Fish and Wildlife Service, and University of Florida.
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Florida Forest Service, Florida Atlantic University, University of Florida, University of Central Florida, University of South Florida, Brevard and Indian River Counties.

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project):

Florida Power and Light, Florida Department of Transportation, St Johns Water Control District, Melbourne-Tillman Water Control District, Fellsmere Water Control District, St. Johns River Alliance, City of Melbourne, Upper St. Johns River Basin Research and management Consortium, local municipalities and adjacent landowners.

Overview/history (200-word limit):

Current project features in the USJRBP include five Water Management Areas (WMAs), four Marsh Conservation Areas (MCAs), and five Detention / Retention Areas. Generally, the WMAs are used for water quality purposes to segregate and treat agricultural runoff and then release cleaner water to the more pristine wetlands in the MCAs. Detention and Retention Areas serve more of a hydrologic function, by retaining or detaining flood waters and allowing a slow release into the MCAs. By having a large expanse of wetland area in the MCAs, the District is able to provide flood control, while also enhancing the habitat value of the USJRBP.

Most of our efforts, now that project construction is complete, are focused on managing all project features with an adaptive management approach. We utilize a variety of tools to manage the lands in the USJRBP, such as hydrologic operational adjustments, prescribed burns, and chemical and mechanical treatments to manage invasive plants. We evaluate the hydrological and biological impacts of those management activities to assess best management approaches to achieve program goals.

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe. (see table below)

There is only one wetland restoration project that is incomplete - Fellsmere Water Management Area. This project area was previously used for pasture, citrus, sod and row crop. Once restored, this WMA will serve to improve water quality, provide water supply, reduce freshwater discharges to the IRL, provide flow augmentation during low flow periods to downstream reaches of the St. Johns River, and restore wetland habitat.

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness (see table below).

In the entire USJRB, over 29,000 ha of wetlands have been restored on former agricultural lands, increasing wetland habitat on the annual floodplain by over 50%. Additionally, by restoring more natural hydropatterns in existing wetlands, the project has improved habitat conditions over an additional 20,000 hectares.

The following table presents details for all 11 wetland restoration projects in the entire USJRB. Those highlighted in grey do not fall within the USJRBP boundary.

Table 1. Restoration Areas in the USRJB

Project Area Name	Size of Restored Area (ha)	Manager	Partner(s)	Former Land Use	Date Initiated	Date Complete	Restoration/ Rehabilitation Activity
Banjo Groves RA	86	SJRWMD	NRCS/FDOT	Citrus	2006	2009	Removed trees, terra-formed, reconnected to adjacent marshes
Broadmoor Marsh RA	1117	FFWCC	SJRWMD, NRCS, Ducks Unlimited	Pasture	1998	2002	Removed infrastructure, reflooded, created habitat islands; managing for waterfowl and wildlife
C-54 Retention Area (T.M. Goodwin Waterfowl MA)	1556	FFWCC	SJRWMD, FFWCC	Pasture	1991?	1991	Removed infrastructure, reflooded, managing for waterfowl and wildlife
Fellsmere WMA	4157	SJRWMD	FFWCC	Citrus, Pasture	2007	2017	Removed trees, terra-formed, created wildlife habitat attractants; built levees; improved water control structures
Fort Drum MCA	4046	SJRWMD	NRCS	Pasture	2001	2006	Degraded 69 km of farm levees to restore hydrology, installed plugs and breached internal levees
Kenansville Lake	1036	SJRWMD	ACOE, FFWCC	Pasture	1993	1997	Closed wells, reflooded and reconnected to downstream marshes; deeply flooded due to subsidence

Moccasin Island Marsh RA	5710	SJRWMD	NRCS, FDOT	Pasture	2000	2014	Removed infrastructure, removed levees, installed ditch plugs, planted marsh species, reconnected to adjacent marsh
Sawgrass Lake WMA	728	SJRWMD	SJRWMD	Pasture	2009	2011	Removed farm infrastructure, installed water control structures to create treatment wetland, reflooded to encourage wetland plants; managed for water quality
Sixmile Creek Marsh RA	1138	SJRWMD	NRCS	Pasture	1996	2002	Removed infrastructure (47 km of fence removed, 16 wells decommissioned), reflooded and reconnected to adjacent marshes
St. Johns WMA	2630	SJRWMD	ACOE, FFWCC	Pasture	2005?	2005	Removed infrastructure, deeply flooded due to subsidence, managed for water quality improvement and fisheries
Three Forks MCA	5444	SJRWMD	ACOE, FDOT	Pasture	1994	2016	Removed infrastructure, reflooded, managing for water quality improvement of upstream discharges
Turkey Creek Marsh RA	1640	FDOF	SJRWMD, FDOF, NRCS, FDOT	Pasture	2010	2018	Removed farms levees, filled canals in floodplain; installed culverts in uplands; reconnected old Turkey Creek stream channel and hydrologically reconnected restoration area to floodplain
TOTAL	***29,288***						

Four example projects are discussed below to give some specifics about effectiveness and performance.

Wetland Restoration Projects

Six-Mile Creek Marsh Restoration Area - This area was impacted by drainage operations and was converted to pasture in the 1950s. Restoration efforts, beginning in 1997, included hydrologic modifications (primarily ditch plugs), removal of infrastructure (47 km of fence removed, 16 wells decommissioned), and treatment of invasive aquatics. Wetland plant communities were re-established through shallow flooding and recruitment from the seedbank. Water quality improved just six years post-restoration: TP was reduced from 0.480 to 0.193 mg/l and TN was reduced from 3.15 mg/l to 1.26 mg/l. After water quality improvement, the restoration area was hydrologically reconnected to the floodplain wetlands of the St. Johns River. The project was completed in 2001 and was partially funded by NRCS-USDA ($285,000).

Broadmoor Marsh Restoration Area – This former floodplain marsh was drained for agriculture prior to the District purchasing the land in 1997. Water being discharged from this area had extremely high nutrients, due to its proximity to a dairy operation. The District intended to restore wetland habitat in Broadmoor and improve water quality discharges, eventually reconnecting with adjacent USJRBP marshes. However, the site had suffered substantial subsidence, and when it became clear that pumping and permanent isolation would be necessary to create and maintain wetland habitats, the District and NRCS partnered with Ducks Unlimited to restore Broadmoor. Restoration was completed in 2002 for nearly $1.7M. The District signed a management agreement (providing $25K/yr. funding) with FFWCC to manage the site together with the T.M. Goodwin Waterfowl Management Area, Florida's first and only waterfowl management area. The acquisition was accomplished with NRCS Wetland Reserve Program

cost-share funding, with NRCS paying $4.2M for a 30-year conservation easement over the restoration site.

Water Quality Improvement Projects

Sawgrass Lake Water Management Area – This area has approximately 728 hectares of active treatment wetland that came on-line in 2011. The performance of this wetland has been outstanding. Except for 2017, when an extended drought dried out most of the wetland, efficiencies were 87% removal of nitrate and nitrite, 93% removal of total suspended solid (TSS), and 85% removal of total phosphorus (TP). The percent removal would have been even greater, if the wetland had been more heavily loaded. Within a third of the distance of the flow path (~3.5 km), the wetland reduced incoming concentrations to background concentrations (TP ~ 0.017 mg/L and TN ~ 1.75 mg/L). Although there has been an increase in Total Kjeldahl nitrogen (TKN) concentration from inflows to outflows, these values are more characteristic of wetlands that have high dissolved organic matter from the incomplete decay of vegetation.

St. Johns Water Management Area - The St. Johns Water Management Area is an approximately 2,428-ha, open-water reservoir designed to work as two sequential pools to increase average water retention time and, thereby, phosphorus removal. The efficiency of the area is currently being assessed and only phosphorus computations are complete at this time. The sequential-pool reservoir removed an average of 35% of the TP, over the years it was treating farm runoff (1997-2009). In this heavily loaded system, that equates to approximately nine (9) metric tons of phosphorus per year for a total of 138 metric tons. While SJWMA is still an active water quality treatment area, it treats far less water since Fellsmere WMA was brought on-line in 2009.

Start and end dates (dates can overlap – estimates are acceptable):

- Planning: 1957 – ACOE proposes a ***highly*** structural project design
  1966 – Project construction begins
  1969 – National Environmental Policy Act requires an Enviro Impact Statement
  1972 – Construction halted pending EIS; State of Florida withdraws sponsorship due to anticipated negative impact of the original, highly structural design on wetland habitats
  1977 – Project sponsorship is transferred to the District
  1986 – Project was redesigned w/ "semi-structural" water management concept
- Construction: 1988 – Construction restarted
  2016 – Construction completed
- Monitoring: On-going

Cost – Financing (estimates are acceptable):

- **Planning, construction: $250+ million**
- **Monitoring:**

  Hydrologic (2016 estimate) - Surface Water - $260K/year; Groundwater - $106K; Rainfall - $38K/year; Evapotranspiration/CO2 - $25K/year | **Total = $429K/year**

  Water Quality (2016 estimate) – Surface water - $333K/year; Groundwater - $10K/year | **Total = $343K/year**

  Plant Community Mapping - $425K every 7 years | **Total = $61K/year**

Cattail Monitoring (imagery/mapping) - $17K every 2 years | **Total = $8.5K/year**
Snail Kites - **$20K/year**
Snail/Fish Surveys (for contaminants) - **$10K/year**
Aerial Recon Flights - **$5.5K/year**

- **Continual (are there ongoing maintenance costs that will be required?):**
  The average Operation and Maintenance budget over last 5 years equals ***$1-3 million per year***. This includes, but is not limited to:
  - Inspections – levees and water control structures (culverts and spillways)
  - Levee maintenance (mowing, herbiciding, damage repair)
  - Water control structure maintenance (yearly) and rehabilitation (every 3-5 years)
  - Pump station operation and maintenance

  Additional Management Costs:
  Gopher Tortoise Relocation - **$135K/year**
  Invasive Plant Management - **$1M/year**
  Burn Management - $**42K/year**

Estimated Grand Total - **Annual Monitoring = $877,000**

Annual Operation and Maintenance = $2,000,000*

Annual Management = $1,177,000

Grand Total = ~$4,054,000 Annual Costs *assumes 2M O&M Costs

Resulting benefits (please list what was measured and how):

- Flood control
- Water quality improvements
- Freshwater Discharge
- Hydrological conditions
- Wetland restoration
- Biodiversity/productivity
- Listed species
- Economically important species
- Public access, recreation, awareness
- Nutrient removal
- Tourism and recreation
- Agriculture water supply and freeze protection

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.):
The District employs an adaptive management approach to achieving the established goals and objectives of the USJRBP. The District monitors water quality, hydrology, and biology in the Project and these data are routinely analyzed to determine how well project objectives are being met. When improvement is needed, new management strategies are developed and initiated, and monitoring continues to determine

if adaptive changes have resulted in objectives being met. Below is a description of the processes for measuring progress for each environmental goal.

Flood Control

Flood control has been improved through acquisition and restoration of former wetlands in the basin that provide for flood water storage and allow the slow release of water downstream through a series of water control structures. This approach has minimized the need for more extensive flood control levees, and, provided an opportunity for the return of more natural hydrologic regimes. When water levels are high, large water control structures are operated to provide flood protection. However, when water levels are below flood stages, weirs and culverts provide downstream discharges for environmental benefits.

Discharge of Freshwater to Indian River Lagoon (IRL)

The metric to measure this objective is the storm event which requires discharge to the IRL. The target of the Project is the 1 in 25-year storm. This has been achieved with the portions of the Project (in Indian River County) that were constructed prior to 1996. We have only released storm discharges to the IRL on four occasions (Hurricane Irene in 1999, Hurricanes Jean, Francis, and Charley in 2004, TS Faye in 2008, and Hurricane Irma in 2017).

Water Quality

The District maintains a network of 48 surface water stations throughout the USJRBP which are sampled monthly and 21 wells that are sampled annually for water quality. In addition, the District has outfitted five of those stations with continuous monitoring equipment and nine stations are randomly selected for more intense stormwater monitoring. Phosphorus has been identified as the principal nutrient of concern in the Project area. A concentration goal of 0.09 mg/L TP has been established for the river and 0.05 mg/L TP for the wetlands in the USJRBP. Phosphorus Pollution Load Reduction Goals (PLRGs) have been set for the two river lakes in the USJRBP and a Total Maximum Daily Load (TMDL) for TP has been established for one of those two lakes. The District is engaged in adaptive management practices in an effort to achieve our TMDL. All data is loaded to the federal STORET database.

Hydrologic Conditions

The restoration of a more natural hydrologic regime is measured in terms of meeting the environmental hydrologic criteria (EHC). The District maintains automatic telemetered gauges at 68 stations in the Project area which measure water level and transmit the information to District Headquarters. These data are stored in an electronic database and analyzed on an annual basis to determine if long-term criteria are being met. If the criteria are not being met, staff may recommend management activities such as improving conveyance, or changes in the operating guidelines for the water control structures in order to meet the criteria. Changes here will also help improve water quality.

Wetland Restoration

In the entire USJRB, over 29,000 ha of wetlands have been restored on former agricultural lands, increasing wetland habitat on the annual floodplain by over 50%. Additionally, by restoring more natural hydropatterns in existing wetlands, the project has improved habitat conditions over an additional 20,000 ha. This increase in wetland habitat is critical to maintaining biodiversity and productivity and has led to increasing wildlife populations.

Biological Diversity and Productivity

Environmental improvements, such as improved water quality, wetland restoration, and habitat management are important in maintaining the productivity of many plant and animal species present in the basin. Several metrics have been established to determine if biodiversity is being preserved. Because plant community diversity is often the basis for animal species diversity, plant communities in the USJRB are mapped from aerial imagery and changes in the spatial distribution and extent of each community type is analyzed on a 7-year cycle. If disturbance community types, such as cattails or willows, are seen to be expanding, studies are undertaken to determine the cause and tools are developed to curb/reverse the expansion.

In the past, the District partnered with other state and federal entities to monitor the number and species of wading birds using the basin for nesting and foraging. Because wading birds are a top predator and highly mobile, they are a good indicator of the overall condition of the wetlands. The District documented that several new colonies of nesting wood storks have been re-established in the basin. In 2005, the USJRB supported over 1,200 wood stork nests and over 13,000 wading bird nests in a single season. Waterfowl have increased substantially since the early 1980s; the number of individuals was low (0 to 1,500 birds) until 1981 and peaks as high as 20,000 birds were documented in the early 2000s. Noting that numbers have continued to increase, in T.M. Goodwin and Broadmoor Marsh RA, since 2000, it is likely that waterfowl in the entire USJRBP have increased as well.

Listed Species

Surveys of species listed as threatened, endangered, or rare have been conducted on areas that have a diverse mixture of habitats (FDMCA, Bull Creek). The maintenance of populations of these species is key to the preservation of biodiversity. In cooperation with other state and federal entities, the District also monitors the population of endangered snail kites in the USJRBP. In 1990, the snail kite returned to historical nesting areas in the USJRBP and, despite wide population fluctuations over the years, has recently rebounded with 22 nests documented during the 2016 season. With the invasion of exotic apple snails, snail kite activity has continued to increase and, so far in 2018, there have been 27 nests established with 25 known fledglings; most in areas that have never supported nests, historically.

Economically Important Species

In the USJRB, economically important species are those associated with recreation - primarily sport fish and waterfowl. The District uses data gathered by FFWCC to evaluate how well the Project is protecting the natural levels of productivity of economically important species that are exploited for recreational fishing and hunting. Recreational sport fishing is extremely popular in the St. Johns River and the most sought after freshwater species include largemouth bass (*Micropterus salmoides*), black crappie, bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), and redbreast sunfish (*Lepomis auritus*). Historically, annual angler sport fishing on the entire St. Johns River exceeded 2,300 man-hours per river km with yields exceeding 2,200 fish per river km, making it the second-most productive river in Florida. Creel survey data from the Stick Marsh, a water management area in the USJRBP, has some of the highest peak season effort and catch-per-unit-effort in the state. In fact, the Florida Fish and Wildlife Conservation Commission touts the Stick Marsh as one of the top 10 trophy bass spots in the state.

Since 1995, harvested waterfowl numbers have climbed in the only Waterfowl Management Area in the state of Florida (T.M. Goodwin Waterfowl Mgmt Area), with annual harvest totals ranging from 740 (before restoration in 1999-2000) to 6,122 (after restoration in 2014-15). The increase in total hunter trips and harvested waterfowl since the 2002-03 hunting season can be attributed to the opening of the Broadmoor Marsh Restoration Area for hunting.

Public Access and Recreation

The USJRBP design also included project elements that have significantly increased public access and recreational uses. Several boat ramps were constructed, as well as, inclement weather shelters and campsites along the river for boaters and other recreationalists. In addition, access routes for bank fishing, camping, hiking, bicycling and horseback riding have been created. Since 2010, there has been a burgeoning ecotourism industry offering airboat rides at three different recreation pads / facilities in the USJRBP. Over time, use expanded dramatically and by 2016, traditional recreators (hunters, boaters, and fishers) were reporting issues with the volume of customers using commercial airboat tours, a level that was unsustainable, both economically and environmentally. The District contracted researchers to study the recreational use patterns in 2017 and used this information to work together with stakeholders, to come up with a solution. The District decided to enter into a concessionaire's agreement with seven providers that limits their hours of operation, the number of boats/customers using the facility per day and mandates that 5% of the revenue will be used to maintain the rec pad and associated facilities. This process required the District to work creatively within its own policies and procedures to develop a legal, but efficient, public-private partnership.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):

There are no economic analyses on the impact of the UJSRBP per se'. However, Widney et al. (2016; https://wetlands.lab.indiana.edu/doc/pdfs/st_johns_river_watershed.pdf) did discuss the economic impact of the ***entire*** St. Johns River catchment regarding nutrient reduction. They found that:

> "Wetlands of the entire SJR catchment remove 79,873 MT of nitrogen annually just from burial in the soil, with a replacement cost of between $240 million to $150 billion per year. The amount of phosphorus buried yearly is more than 2,400 MT with an annual replacement cost of $17 to $497 million. Though they are based on limited data and include a variety of watershed-scale research limitations, these findings highlight the significant potential value of conserving functional wetlands based solely on their nutrient retention functions. If we were to consider the benefits associated with other wetland functions such as flood control, biological productivity, and biodiversity in addition to their ability to retain nutrients, the value of the SJR wetlands would be even greater."

In 1997, the Stick Marsh was estimated to account for approximately $2.5M annually for sports and non-sports fishing exploits by Florida residents and non-residents. Given the time since this survey and the increase in usage of the Stick Marsh, a current estimate would be more in the realm of $4M per year.

Additionally, a recent 5-month study (2017) of recreational usage on three rec pads in the USJRBP documented that the number of vehicles using the boat ramp and parking facilities ranged from 800 to over 2,000 per month. Use by commercial airboat tour operators and their customers accounted for over 86% of the vehicles using the facility and 92% of all users. The general (non-commercial) recreational

users were primarily anglers and wildlife viewers. Commercial airboat tour customers were estimated to number around 24,000 during the 5-month study period. About half of the customers resided within 50 miles of the 512 Rec Pad with another one-third living 500 or more miles away. Tour customers not residing in the local area typically stayed 3-4 days in the area, with about half staying in a local hotel or bed and breakfast. Customers from the local area spent an average of $230 per group for their airboat tour and related travel expenditures, while non-local customers spent an average of $823 for their entire trip that included the airboat tour.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
Similar to the lack of economic analyses, the USJRBP has not been evaluated for non-market economic benefits, using an ecosystem metric system or any other system. However, it has been noted that the USJRBP is important to local citrus growers for freeze protection and water supply.

> "The Upper Basin Project has been a game changer for citrus growers in Indian River County," said District Governing Board member Douglas Bournique, who also serves as executive vice president of the Indian River Citrus League. "The availability of water for irrigation and freeze protection has protected our industry time and again." https://www.sjrwmd.com/2016/08/district-partners-celebrate-milestone-at-upper-st-johns-river-basin-project/

Are benefits based on actual measures or did you use a model to predict benefits? (see below): No information provided.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response)
As to the appropriateness of the Project design relative to the specific geographic and socioeconomic features of the region, the Project was vetted through several levels of public review and ultimately deemed by the US federal government to have a most favorable cost-benefit ratio of 1:1.7. That is, the Project returns $1.70 USD in benefits for every $1.00 USD of public funds invested for its implementation. Moreover, the cost-benefit ratio for the Project was calculated in the early 1980s, long before additional enhancements, expansions and improvements were made to what has become the final Project design. The District estimates that the actual cost-benefit ratio is now much more favorable than the initial ratio used to justify the Project financially. (Source: U.S. Army Corps of Engineers (1985) "Upper St Johns River Basin and related areas – General Design Memorandum". Jacksonville, FL)

If you do not have any data currently available in regard to benefits, how do you plan to measure them? Discussed in above section

Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? If so, please describe.

- **Innovative Designs - "Semi-Structural" Design**

During the 1970s, flood control projects in Florida usually entailed highly structural designs, where upland reservoirs were constructed to intercept stormwater inflow and divert it to tide through a series of

interbasin diversion canals. Rather than use this highly engineered and environmentally detrimental design, the guiding design principle for the USJRBP was to acquire as much of the historic riverine floodplain as possible to create Water Management and Marsh Conservation Areas to store and treat stormwater and to minimize discharges to the Indian River Lagoon. This approach was termed a "semi-structural" approach to floodplain management and was hailed as a "national model of modern floodplain management" by the state of Florida's lead environmental agency—the Florida Department of Environmental Protection.

- **Technologies - Phased Restoration Approach**

A three-phased approach to restoration was first utilized in 1997 in the Sixmile Creek Marsh Restoration Area. Phase I involved the removal of agricultural infrastructure and remediation of any contamination from past agricultural practices. Hydrologic modifications were made by backfilling internal canals and installing water control structures to allow for water level manipulations needed for the next phase. Phase I also involved the decommissioning of free-flowing wells, removal of fences and culverts, backfilling major internal canals and placing strategic breaches or breaks in internal levees to allow for the free exchange of water inside the property. Phase II involved reflooding and maintenance of shallow water levels to encourage growth of wetland plants from the remnant seed bank in the soil. In addition, native species were planted and exotic plants were controlled. Once water quality improvement was achieved (the goal was to reach background levels of nutrients of concern, primarily P), Phase III was implemented. This entailed complete reconnection of the restoration property to the St. Johns River floodplain and continuing to manage the property by conducting prescription burns, treating exotic plants, and monitoring plants, animals, and water quality in the newly restored area.

- **Technologies – Hydrologic Vegetation Prediction Model**

Wetland managers frequently need to predict the spatial extent of plant community associations that will develop in wetland restoration areas. While there are other factors that determine plant distributions (propagule distribution, water quality, soil characteristics, etc.), the model we developed incorporated the primary determinant of wetland plant distributions – hydrology. Using data from 36 studies (primarily located in Florida, USA), we documented considerable overlap in the hydrologic conditions that each plant community can tolerate. We applied a weighted scoring system, using four hydrologic parameters, to determine which plant communities would occur under a given set of hydrologic conditions. Inundation frequency and average annual depth were weighted at 30% each because they represent long-term conditions and we considered them to be more important determinants of plant community structure. Maximum and minimum 1-day depth, which incorporate extreme and short-term dry down and flooding events, were each weighted at 20%. Summed hydrologic scores were used as an index to predict which plant community would develop under the hydrologic conditions being considered. The model can also be used to determine which plants should be installed at specific locations along the topographic gradient or to predict the long-term outcome of flooding an area that relies on the remnant seed bank and outside propagules to colonize the site. Ultimately, this model provided a mechanism for evaluating multiple hydrologic scenarios in order to choose the construction design that maximized the chance of success.

- **Policies - Environmental Hydrologic Water Management Plan**

First and foremost, the USJRBP is a flood control project. Typically, operational schedules are dictated by the ACOE in a Water Control Plan and little deviation from that plan is allowable. When the

maximum storage capacity of the project area has been reached, large-scale discharges must be made downstream for flood control. However, if water levels strictly follow the flood control schedule, basin wetlands would experience hydrologic conditions opposite to those experienced naturally (i.e. the lowest annual water levels would occur during the rainy summer months and the highest annual water levels would occur during the typical dry season). Fortunately, the District was able to work with the ACOE to compromise on regulation schedules for the USJRBP during the times when flood control is not a concern. These modifications make it possible for the District to meet the environmental needs of the ecosystem by allowing discharges whenever water levels are below the flood control regulation schedule. An Environmental Water Management Plan was drafted to direct operation of water control structures to meet a suite of environmental hydrologic criteria (EHC) that provide numerical targets representing optimal hydrologic conditions for USJRB wetlands.

- **Policies - Stakeholder Engagement**

From the inception of the USJRBP, the District and the ACOE deliberately engaged stakeholders in Project development, implementation and review. Considerable time and effort were dedicated to informing local groups about the Project. Project staff met regularly with the Indian River Citrus League, which represented most of the agricultural interests on the east side of the Project area, to discuss progress and modified the Project design to address the League's concerns. In addition, a citizen's Technical Advisory Committee was formed that was comprised of stakeholder representatives of governmental and non-governmental organizations to help ensure Project functionality. The formation of a citizen advisory group was a novel approach, when first employed in the late-1970s, and one that the District utilized for future basin-wide planning initiatives. Currently, Recreational Public Meetings are held three times per year where the District presents land management updates, capital project updates, and recreational updates to members of the public. In addition, select groups of natural resource stakeholders serve on Land Management Review Teams to determine if land management objectives, that are set forth in the Land Management Plans for each conservation areas, are being met and that the District is meeting the original objectives for which the land was acquired. Finally, in 2015, the District organized a forum for information exchange between scientists, researchers and managers from three federal agencies (USACE, USFWS, USGS), four universities (FAU, UCF, UF, USF), two state agencies (FFWCC, SJRWMD) and several private consultants. The mission of the USJRB Research and Management Consortium is to enable communication among a diverse group of managers, scientists, and researchers in order to craft a road-map outlining important and emerging topics and to identify strategic collaborations to pursue coordinated research and management aimed at the preservation, restoration, and management of the lands in the USJRB.

Lessons Learned:

Over the years of project construction, operation, and management there have been several unexpected events that we, as managers, have had to adapt to. A short list of a few of those challenges / opportunities are:

1) Although project structures were installed with the best information available at the time, water flow and hydraulics at some structures near Fort Drum MCA were not ideal. After new topographic information showed that some structures were not installed at the lowest elevations, the District had to install new structures to alleviate flooding and restore wetland hydrology.

Lesson – detailed and up-to-date elevation data is critical to ensure proper hydrologic functioning.

2) Water Management Areas were designed primarily for water quality improvement. However, when the endangered snail kite reappeared at the Blue Cypress WMA, the District had to consult with the US FWS and a biological opinion was written. That necessitated a different hydrologic operational regime to protect the kites, despite not necessarily being the best water levels for water quality treatment. Biological monitoring was also required to ensure that our management was not impacting the kites.

Lesson – contingency plans should strike a delicate balance between intended use of an area for one wetland function and accommodation of other, unintended uses. Funding for monitoring should be considered.

3) Early wetland restoration projects in the USJRBP followed a simple model of a "flood it and they will come" mentality and most preparation prior to flooding was merely the removal of structural improvements and testing of soil for contaminants. It wasn't until a bird mortality event occurred in the Lake Apopka wetland restoration project, that monitoring for contaminants in prey fauna became a required restoration practice in the entire District. Now, biological assessments are required prior to implementation of restoration. Monitoring of wetland fauna (fish and apple snails), in consultation with USFWS, is accomplished in areas where contaminants in prey fauna of listed species may be a concern. Pesticides have been well below the level of concern in the prey fauna of USJRBP Restoration Areas.

Lesson – budget money and time into restoration projects to complete contamination assessments and monitoring.

4) Plant communities on several restoration projects in the USJBRP have not developed the way that the District anticipated them to, becoming dominated by invasive, native plants (e.g., *Typha* spp.) and exotic species (e.g., *Cyperus blepharoleptos, Panicum repens*) early in the restoration. This prompted multiple chemical treatments, in concert with burning and flooding to try to control these undesirable species. In fact, there are some MCAs that have the same issues where the District tried to manage "against" one invasive species, only to be replaced by another invasive species (e.g. *Typha* sp. replaced by *Salix caroliniana*).

Lessons – Restoration projects: budget money and time for planting desirable, native species and follow-up chemical treatments for a long time-frame (5-10 yrs.). Management projects: proceed carefully with chemically treating species before you know what caused the issue in the first place and predict what will replace the "undesirable" plants with each management action.

5) Agricultural areas, that were purchased for wetland restoration, often had little topographic information available. While the aim was to restore wetlands to these sites, the District found that elevation differences between restoration areas and the adjacent floodplain were much greater than anticipated. Ground subsidence necessitated pumping, rather than hydrologic reconnection and gravity flow, in order to restore emergent wetlands. Since budgets were not sufficient to support pumping in perpetuity, an acceptance of rehabilitation, rather than restoration, was required in areas that had greatly subsided (Kenansville Lake, St. Johns WMA, Broadmoor Marsh RA).

Lessons – Obtain good topographic data prior to purchasing properties for wetland restoration. Areas that have been farmed for row crops have much greater subsidence than those used for pasture or native range. Managers need to choose whether to rehabilitate the area and allow deep water habitat to develop or make a long-term commitment / partnership to fund pumping in the long-term.

6) Frequently, there are conflicting recreational uses in the USJRBP. As mentioned earlier, there was tremendous recreational pressure on the CR512 rec pad in the USJRBP, where commercial airboat tour companies were competing for use with traditional anglers and hunters. This was addressed by completing a recreational use evaluation and engaging stakeholders in coming up with a solution that all parties considered favorable. In another example, duck hunters wanted to use the Fellsmere WMA before construction was even complete in that area. The District compromised by allowing hunters to canoe into certain portions of the property where construction was complete; this upheld an agreement we had with the former landowner.

Lesson – engage stakeholders early and often during the process of restoration (including planning, execution, and long-term management) and come up with creative solutions to allow multiple uses of wetland areas in the USJRBP.

7) While endangered snail kite populations were declining in the state, managers feared that the appearance of an invasive apple snail might result in a crash of the native apple snail population, thereby affecting snail kites who depend on those snails as their sole food source. Unexpectedly, snail kites have adapted, morphologically and behaviorally, to eating the abundant, invasive snails. Populations, of both invasive snails and snail kites, are on the rise and snail kites are nesting in areas where they never did historically.

Lesson – Expect the unexpected!!

Other items to share: Awards and Accomplishments

1998 - The St. Johns River was designated an American Heritage River by President Clinton. The St. Johns is the only river in Florida and one of only 14 rivers in the entire United States to receive this prestigious national recognition. https://clintonwhitehouse2.archives.gov/CEQ/Rivers/

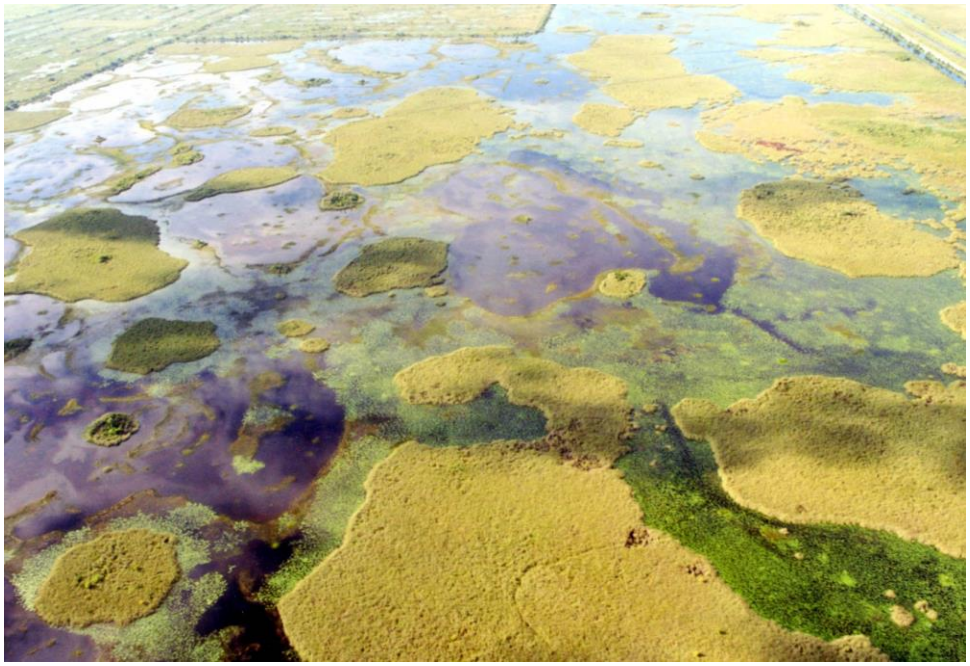
2008 – Theiss International River Prize given by Australia's University of Queensland. The USJRB project was internationally recognized for using innovative approaches in design and management to combine environmental benefits with flood damage reduction.
https://www.dredgemag.com/2008/11/03/st-johns-river-project-wins-thiess-riverprize-in-australia/

2016 - Florida Engineering Society lauded the Upper Basin Project as a *Project of the Century*, competing against such inventive projects as air conditioning and the Hubble Space Telescope. According to the engineering committee, the projects provided witness of engineering excellence.
http://www.saj.usace.army.mil/Media/News-Releases/Article/925965/agencies-complete-one-of-the-largest-wetland-restoration-projects-in-history/

Do you have any images or photos to share?

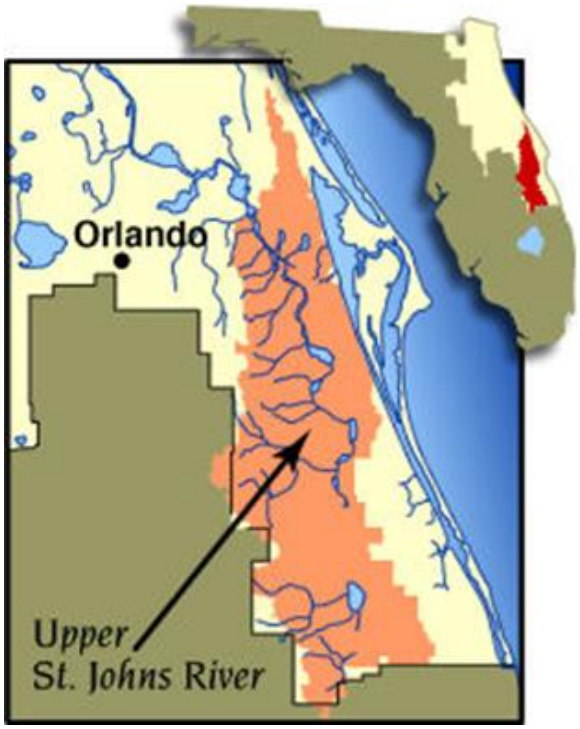
Mosaic of wetland plant communities with white water lily (*Nymphaea odorata*) sloughs, sawgrass (*Cladium jamaicense*) patches and cypress (*Taxodium* spp.) tree islands.
Photo credit: Vickie Larson, Ecospatial Analysts, Inc.

Mosaic of wetland plant communities with white water lily (*Nymphaea odorata*) sloughs and sawgrass (*Cladium jamaicense*) patches.
Photo credit: SJRWMD



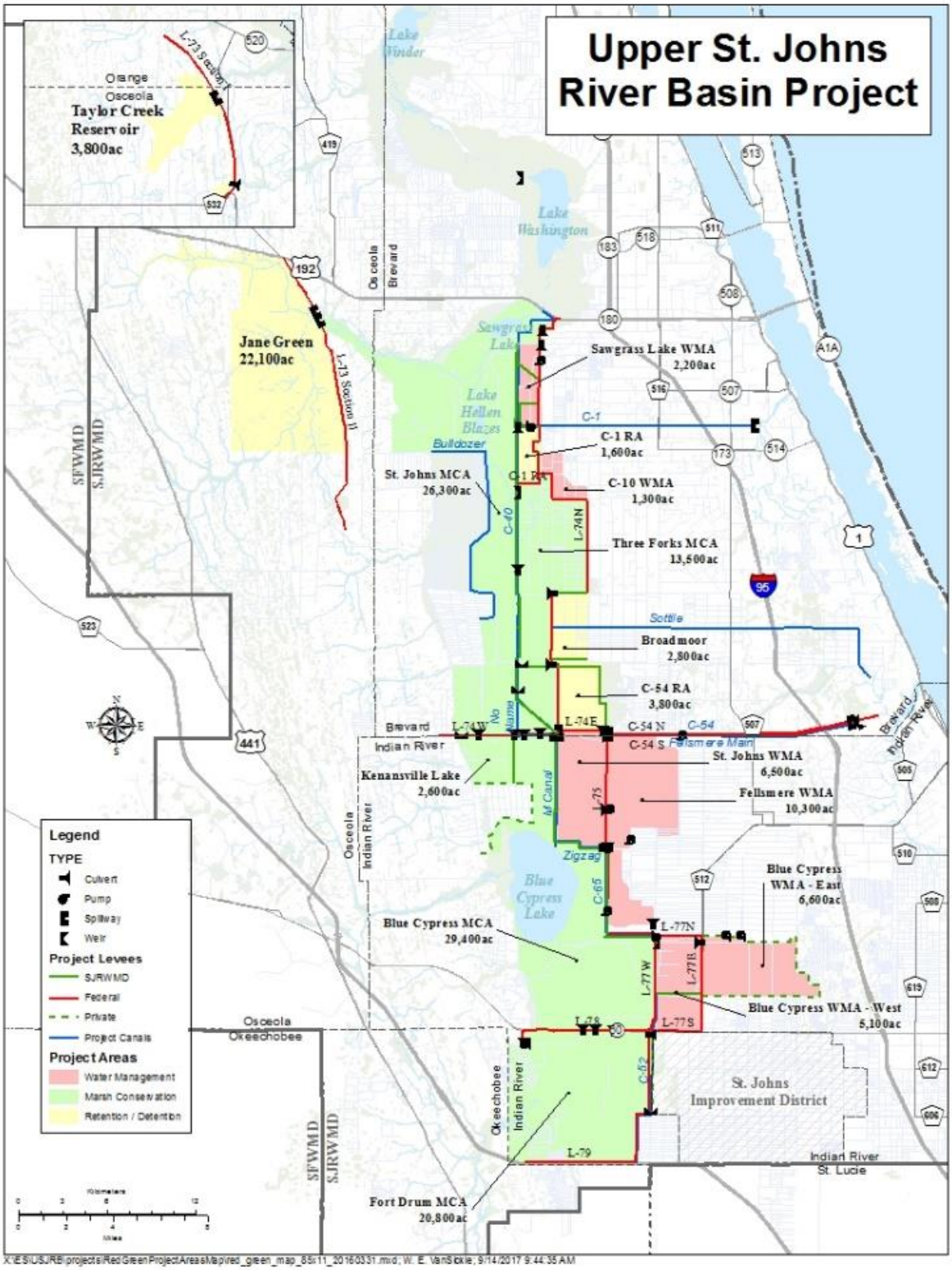
Aerial view of Blue Cypress Water Management Area showing white water lily sloughs, interspersed with sawgrass patches. A large remnant tomato farm, that has been reclaimed, is visible in the top left of the image.
Photo credit: SJRWMD

Summer thunderstorm over sawgrass (*Cladium jamaicense*) marshes in the TFMCA.
Photo credit: Kimberli Ponzio, SJRWMD

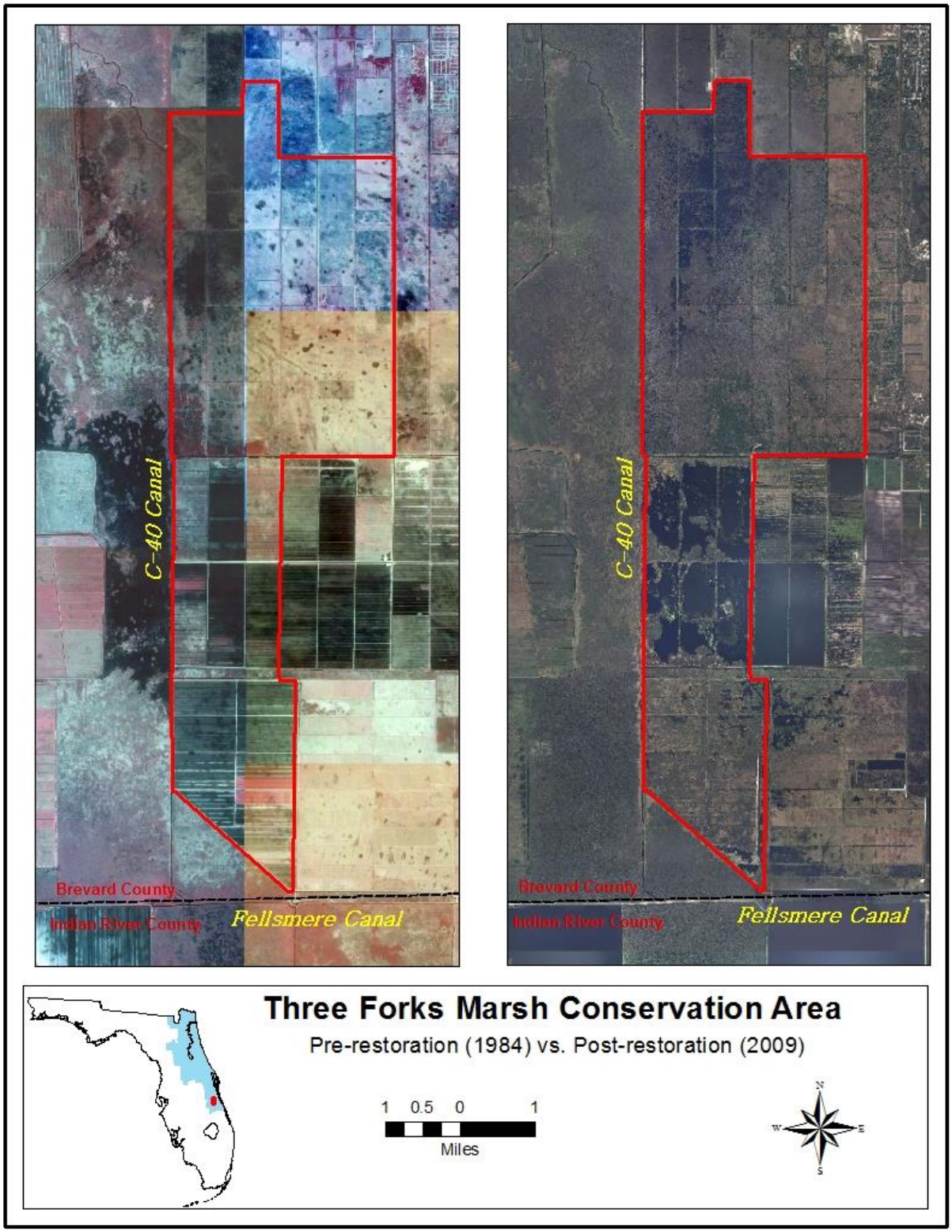


Location of the Upper St. Johns River Basin
In the state of Florida
Map credit: SJRWMD

Location of the Upper St. Johns River Basin
in the state of Florida.
Map credit: SJRWMD



Location of the Upper St. Johns River Basin Project area showing Water Management Areas, Conservation Areas, and Retention/Detention Basins.
Map credit: SJRWMD



Pre- and Post-restoration map of the TFMCA showing row crops and pasture being converted to wetlands of varying depths.
Photo credit: Kimberli Ponzio, SJRWMD

FMI (please include contact name, organization, website, phone number and/or email address):

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VERMILLION RIVER WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed:
Vermillion River Watershed, located in Minnesota

Size of watershed (in acres): 214,400 acres

Title of Project/Initiative:
Vermillion River Watershed Joint Powers Organization

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
- X Rural (anything outside the urban area)
- X Inland
- __ Coastal

Need/Challenge Addressed (200 word limit):
Surface water quality is threatened or impaired in the watershed. Water quality improvement competes with other public, private, and individual priorities. There is a perception that costs of improving water quality are not allocated fairly. Groundwater quality is at risk, with known contamination above health risk limits for nitrate in some areas. Increasing consumption of groundwater threatens the future water supply. Changing precipitation patterns, decreased rainwater infiltration, and increased stormwater runoff have contributed to more intense fluctuations in river flow rate and volume. Public awareness and specific knowledge on the impacts of daily activities and appropriate stewardship is lacking. Several federal, state, and local agencies manage specific aspects of water protection, and limited coordination and communication among these agencies can create inefficiencies and cause confusion. Minnesota's climate is getting warmer and wetter, which poses a threat to water quality, wildlife, and infrastructure. The Vermillion River Watershed JPO is a "young" organization in a dynamically changing landscape and has not always been able to fill gaps and address new opportunities. 10. Sensitive biological resources -- plants, fish, insects, and wildlife -- in the Vermillion River are not as healthy as those in reference rivers

Goals & Objectives (please include ecosystem services/values focused on):

1. Protect or restore water quality in lakes, streams, and wetlands.
2. Protect and restore groundwater quality.
3. Maintain a sustainable water supply.
4. Address more intense fluctuations (up and down) in river flow rate and volume.
5. Improve public awareness and stewardship of water resources.
6. Improve watershed resilience to changing precipitation and temperature patterns.
7. Protect or restore sensitive biological resources, such as plants, fish, insects, and wildlife.

Overall Strategy (i.e., what role do wetlands play in your project?)

Protect or restore water quality in lakes, streams, and wetlands

1. Restore impaired waters and protect those currently not impaired

2. Reduce non-point source pollution, erosion and sedimentation
3. Protect and improve the River corridor
4. Protect, enhance, and restore wetlands
5. Protect and enhance recreational lakes

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

__ Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- Team leaders (organizations, agencies or individuals that are responsible for overall project **direction, outcomes and financing):** Vermillion River Watershed Joint Powers Board (consisting of two Dakota County Commissioners and one Scott County Commissioner), Minnesota Board of Water and Soil Resources (State agency with statutory oversight responsibilities).

- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** 20 cities and townships within the watershed Apple Valley, Burnsville, Castle Rock Township, Coates, Douglas Township, Elko New Market, Empire Township, Eureka Township, Farmington, Hampton, Hampton Township, Hastings, Lakeville, Marshan Township, New Market Township, Nininger Township, Ravenna Township, Rosemount, Vermillion, and Vermillion Township; Dakota and Scott SWCDs.

- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Watershed Planning Commission (made up of 9 citizen advisors); Technical Advisory Group (a group of stakeholders and interested parties that are called upon to provide input to the VRWJPO on projects, programs, and policy with a focus on technical aspects – no formal membership, city staff, engineers, consultants, planners, state agency personnel, academics, non-profit environmental groups).

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Environmental groups and their membership; recreational and outdoor organizations and their membership; farmers; landowners and land-managers; state, county, and local municipal park, transportation, facility, or other land managers; lake associations.

Overview/history (200 word limit):

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe.
Approximately 60 projects, between 8 highest priority subwatersheds

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness.
Information about past projects and performance can be found in the following reports:

- Vermillion River Watershed TMDL Report
- Vermillion River Monitoring Network 2017 Annual Report
- Vermillion River Watershed Joint Powers Organization Annual Activity Reports and Financial Statements

Start and end dates (dates can overlap – estimates are acceptable):

- **Planning:** 2002-2005 (2013-20016)
- **Implementation:** 2016-2025
- **Monitoring:** Ongoing (2016-2015)

Cost – Financing (estimates are acceptable):

- **Planning:** $188,000 (2013-2016)
- **Implementation:** Implementation Planning Table (pages 121-122)
- **Monitoring:** approximately $150,000 - $200,000 annually
- **Continual (are there ongoing maintenance costs that will be required?):** No information provided.

Resulting benefits (please list what was measured and how):

- Flood control
- Water quality improvements
- Hydrological conditions
- Biodiversity/productivity
- Public access, recreation, awareness
- Pollutant removal
- Increased property values
- Habitat protection

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.): stabilizing flow rates, replenishing groundwater, and removing pollutants through filtration and biodegradation, water quality improvement and watershed resilience

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.): Avoided flood damages; avoided costs of erosion damages

(soil loss, soil quality, ravine and stream stabilization costs, equipment impacts from gullies, etc.) and sedimentation impacts (ditch and culvert clean-outs, impacts to properties; increased property values; improved recreational values (fisheries, hunting, bird-watching, canoeing, etc.); reduced infrastructure costs (along with reduced maintenance).

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements): No information provided.

Other: Benefits to ecological stability and resilience.

Are benefits based on actual measures or did you use a model to predict benefits?
Listed benefits above are generalized and conceptual.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response)
No, there currently isn't a formalized cost benefit analysis for this "project". The VRWJPO is a watershed management organization meeting the requirements established by the 1982 Metropolitan Surface Water Management Act covering the Seven County Metropolitan Area of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington Counties in Minnesota.

If you do not have any data currently available in regard to benefits, how do you plan to measure them? The VRWJPO is using published calculators for estimating pollutant reductions for projects funded through the activity of the VRWJPO. These measures may be used over time to estimate benefits derived for the costs incurred. It should be noted that variables such as land values play an important role in overall costs and thus the same practice deriving similar benefits may have differing costs in differing locations and thus skew a straightforward measure of benefits to costs. Monitoring results may also provide indirect measures for benefits over time.

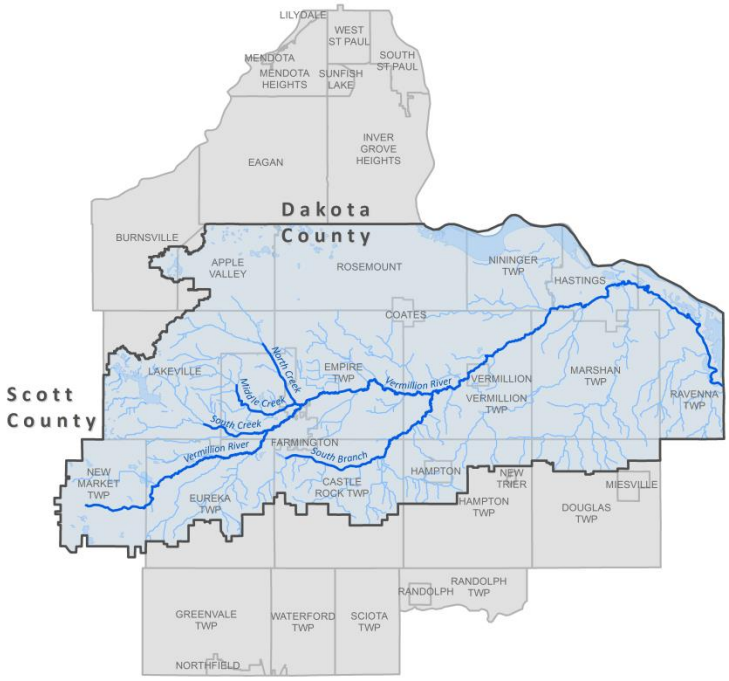
Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe):
There are individual innovative designs, technologies, and policies that have been part of the overall efforts of implementation of the Vermillion River Watershed Management Plan over time. These are included in the Annual Activity Reports of the VRWJPO. Additional innovations are described in the following documents:

- A Joint Powers Agreement between Dakota and Scott Counties
- Metropolitan Surface Water Management Act
- Metropolitan Area Local Water Management Rules

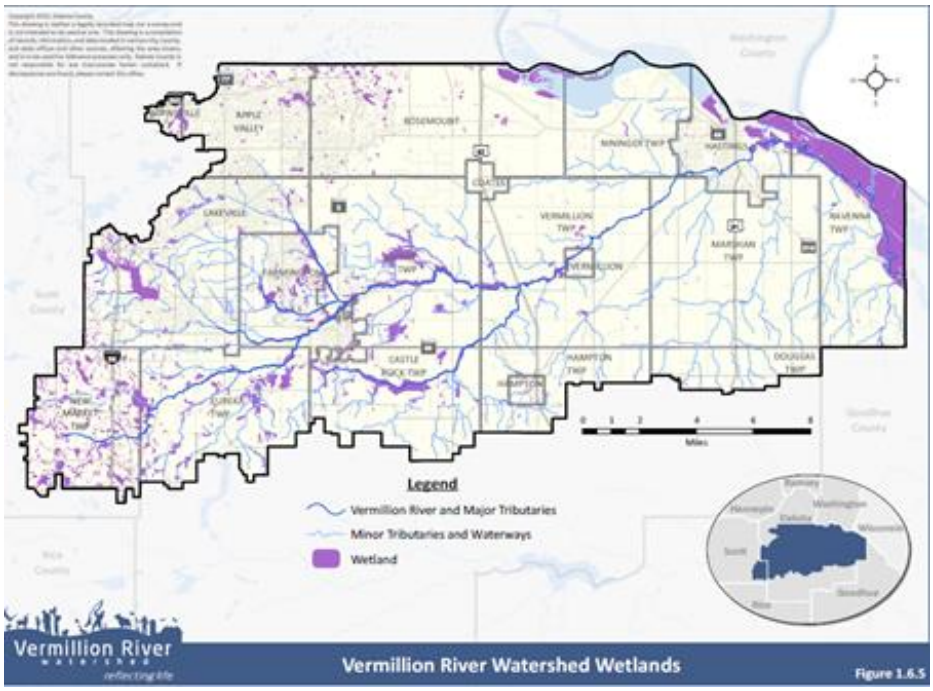
Lessons Learned: The current VRWJPO is a second instance of a Joint Powers. The first instance was a Joint Powers Organization made up of all of the local municipalities within the watershed (21 cities, towns, and townships at that time). The decision-making structure of the organization was cumbersome with the 21 members, leading to internal conflicts and disagreements among member groups. This eventually led to increasing difficulties in implementing programs and projects and eventual dissolution

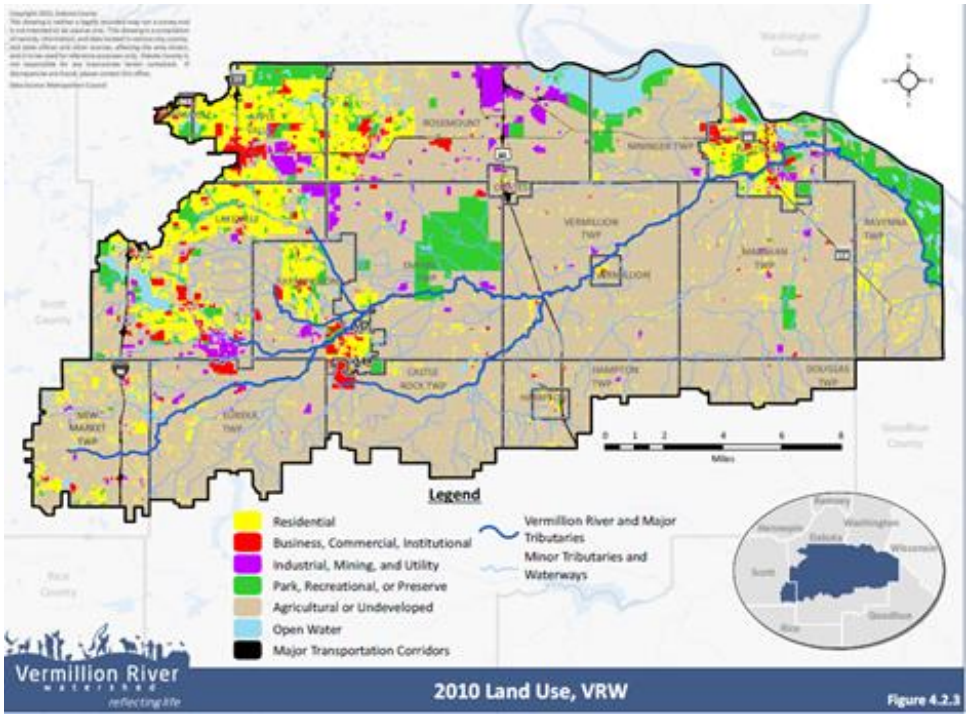
under direction of the Minnesota Board of Water and Soil Resources (the State oversight body). By statute, the responsibilities of watershed management under the Metropolitan Surface Water Management Act would revert to the County level of government. The two Counties involved decided to move forward in a new partnership forming a new instance of a Joint Powers between the two Counties. The new structure of a three member board proved more manageable in terms of decision-making, support, and oversight. In development of the new structure the Counties also authorized a special taxing district to provide direct means for financial support for the organization.

Do you have any images or photos to share?



Vermillion River Watershed Map





FMI (please include contact name, organization, website, phone number and/or email address):
Vermillion River Watershed Management Organization
vermillionriverwatershed.org
952-891-7000
VRWJPO@co.dakota.mn.us

LEWISVILLE LAKE WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed:
Lewisville Lake Watershed located in Denton County, Texas

Size of watershed (in acres):
619,522 acres

Title of Project/Initiative:
Upper Trinity Regional Water District Watershed Protection Program – Denton County Greenbelt Plan

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more
- X Rural (anything outside the urban area)
- X Inland
- __ Coastal

Need/Challenge Addressed (200 word limit):
Preserve and protect natural features/resources and water quality in the Lewisville Lake Watershed, including creeks, floodplains, riparian zones, wetlands, and greenbelts. As a wholesale water and wastewater utility, Upper Trinity has no enforcement authority and relies on customer cities and Denton County to implement strategies appropriate for their area. The greatest challenge is educating the general public on watershed protection and how their daily activities can affect the Lake Lewisville watershed, the main source of drinking water for Denton County communities.

Goals & Objectives (please include ecosystem services/values focused on):
Protecting water quality in water sources by establishing greenbelts, minimizing the use of fertilizers and chemicals, collection of household hazardous waste, education and public awareness. Providing conservation easements for landowners, by establishing a non-profit land trust (Upper Trinity Conservation Trust), as a tool to permanently preserve riparian areas and related natural watershed features, including wetlands. These actions will lead to greater recreational and educational opportunities, and in some cases, increased property values.

Overall Strategy (i.e., what role do wetlands play in your project?)

- Promoting public education and watershed awareness
- Preservation of existing natural areas: including wetlands, floodplains, and riparian lands
- Encouraging cities and developers to utilize low impact development and green infrastructure practices to manage stormwater volumes and pollutant loads
- Encouraging the proper use or minimization of fertilizers and chemicals
- Use of organic and practices in landscaping and gardening activities
- Encouraging native vegetation and reduced mowing in buffer zones between waterways and developed areas
- Use of floodplains for trail systems and open space
- Use of voluntary conservation easements

- Encourage landowners to implement best management practices to reduce pollution and erosion by providing educational and technical resources and connecting them to financial resources

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

__ Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** Larry N. Patterson, P.E., Executive Director; Jason Pierce, Manager of Customer Contracts and Support Services; Blake Alldredge, Water Education Coordinator
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Cities and towns in Denton County, developers
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role**): North Central Texas Council of Governments, Texas A&M AgriLife Extension and Research, Natural Resources Conservation Service, Greenbelt Alliance, Texas A&M Forest Service, Texas Parks and Wildlife Department

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): citizens and communities located within the Lewisville Watershed, with five counties and over twenty towns and citizens that fall within the watershed's total area.

Overview/history (200 word limit):

Upper Trinity Regional Water District is a wholesale water and wastewater provider in Denton County, Texas. Upper Trinity treats water from Lewisville Lake, then distributes that treated water to more than 26 cities and utilities. Denton County is rapidly growing, and development upstream of the reservoir may affect water quality. In response, Upper Trinity began coordinating a regional Watershed Protection Program aimed at educating the public on ways they can protect local water quality in their daily activities, including school education and outreach, water treatment plant tours, watershed signs along roads, and digital advertisements. Upper Trinity also encourages cities to adopt practices that will minimize pollution, such as preserving greenbelts and floodplains, and implementing proactive stormwater management programs. In 2010, Upper Trinity established the Upper Trinity Conservation Trust, a nonprofit land trust, as a separate entity to acquire and hold conservation easements in perpetuity.

The focus of the Trust is to protect the watersheds of Lewisville Lake and other water supply reservoirs by accepting easements in floodplains or greenbelt areas, or other natural features in the watershed.

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe.
See above for background information. In 2015, Upper Trinity, the Trust and Denton County began jointly developing the Denton County Greenbelt Plan to serve as a guide to the preservation of greenbelts, according to a common vision. The Greenbelt Plan is voluntary for cities and developers, but the secondary benefits of adopting the Plan are tremendous.

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness.
Denton County Greenbelt Plan

Start and end dates (dates can overlap – estimates are acceptable):

- Planning: April 2015 – July 2017
- Implementation: August 2017, adopted by Plan Sponsors (Denton County, Upper Trinity Regional Water District and Upper Trinity Conservation Trust)
- Monitoring: No information provided.

Cost – Financing (estimates are acceptable):

- **Planning:** $135,000
- **Implementation:** ~$2,000 annually to promote the Plan
- **Monitoring:** No information provided.
- **Continual (are there ongoing maintenance costs that will be required?):** No information provided.

Resulting benefits (please list what was measured and how:

- Flooding
- Water Quality
- Hydrological Conditions
- Wetland Restoration
- Public access, recreation and awareness
- Reducing water treatment costs
- Habitat protection
- Reduced pollution
- Increased property values
- Education
- Aesthetic value

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.):

- Water quality improvements
- Habitat protection
- Reduced pollutants

** nothing measured

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):
Flood damage costs reduced, increased property values adjacent to greenbelts, forgoing higher water treatment costs or advanced treatment systems at water treatment plants.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
Recreation and aesthetic value, educational opportunities

Other: No information provided.

Are benefits based on actual measures or did you use a model to predict benefits? Neither

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response)
There was a cost-benefit analysis done as part of the Hickory Creek Watershed Protection Plan by the City of Denton that showed maintaining riparian buffers and greenbelts were the most cost effective solution for maintaining water quality in Lake Lewisville. Hickory Creek flows into Lake Lewisville.

If you do not have any data currently available in regard to benefits, how do you plan to measure them?
The do not plan to measure.

Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe): No information provided.

Lessons Learned:
Partnerships and input from a wide range of stakeholders is vital.

Do you have any images or photos to share?
No images provided.

FMI (please include contact name, organization, website, phone number and/or email address):

Upper Trinity Regional Water District
(972) 219-1228
Blake Alldredge, Water Education Coordinator
balldredge@utrwd.com

www.utrwd.com
Denton County Greenbelt Plan website
http://utct.org/greenbelt_plan.html

JEMEZ RIVER WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed:
Jemez River Watershed, New Mexico

Size of watershed (in acres):
661,760 acres

Title of Project/Initiative:
Rio de las Vacas Wetlands Restoration Project

Setting: (please check all that apply)

__ Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
X Rural (anything outside the urban area)
X Inland
__ Coastal

Need/Challenge Addressed (200 word limit):
The Rio de Las Vacas Watershed is a sub-basin of the Jemez River Basin located in north central New Mexico and flows in the Rio Guadalupe. The watershed is approximately 25.1 miles long with a drainage area of approximately 122 square miles. The watershed is dominated by both forest and rangeland. The Jemez River is significantly impaired due to soil erosion, which is thought to have resulted from a variety of natural and other activities such as grazing, recreation, stream bank modification, removal of riparian vegetation, silviculture, road construction and maintenance, and channel widening. Wetland and riparian area restoration techniques and management will be used to improve and enhance watershed.

Goals & Objectives (please include ecosystem services/values focused on):

1. Restore and manage the watersheds on public and private land to enhance water retention and quality and to preserve natural systems dependent on water.
2. Restore wetlands by improving stream conditions, which in turn provide a buffer to naturally protect water quality.
3. Increase awareness of beavers as wetland implementers instead of nuisances, thus subsequently creating more resilient habitat through increased biodiversity and habitat productivity within the watershed.
4. Promote education for all who live, work or visit the area regarding the connection between land use, water, and the environment as well as the importance of water protection and conservation.

Overall Strategy (i.e., what role do wetlands play in your project?)

Watershed assessment and inventory to: 1) collect historical information that outlines effects on stream and watershed condition; 2) collect baseline data to determine the quality of fish habitat and floodplain condition and sources of habitat loss; 3) identify areas for possible migration barrier construction; 4) identify restoration needs; and 5) determine fish species presence and distribution.

Address water quality by: 1) restoring almost 2 miles of stream along Rio de las Vacas; 2) reducing non-point source pollution into the streams by modifying and rehabbing campsites located along Rio de las Vacas; 3) reconstructing and maintaining an existing buck and pole fence on the Middle Rio de las Vacas. This fence helps maintain riparian habitat by excluding vehicle travel on riparian vegetation. 4) restoring the wetlands along the Rio de Las Vacas. Wetlands and riparian areas will be restored using bioengineering, planting of native plants, repairing fences and building cattle and elk mini-enclosures, and installing trick tanks

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

__ Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** Jemez Watershed Group, USDA Forest Service, EPA
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Santa Fe National Forest, Animal Protection of New Mexico, Rangeland Hands Inc., Private Landowners within the watershed, Albuquerque Wildlife Federation, New Mexico Trout Unlimited
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Cuba Soil and Water Conservation District, Zeedyk Ecological Consulting, New Mexico Soil & Water Conservation Districts, New Mexico Department of Agriculture, US Bureau of Reclamation, Rio Puerco y Rio Jemez Subregional Water Planning

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Organizations listed above, various tribal groups and residents of the watershed area.

Overview/history (200 word limit):

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe.
Approximately 40-50 identifiable individual projects

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/ effectiveness. The "Rio de Las Vacas

Wetlands Restoration Project" is the first phase of projects to restore the Rio de Las Vacas. This project restored 39 acres of wetlands and approximately 2.53 miles of riparian area using the following methods and best management practices (BMPs): bioengineering the stream and wetlands; planting native wetland vegetation; repairing fencing and building cattle and elk mini-enclosures; and installing innovative hemi-enclosure fences. In addition to on-the-ground restoration activities, the project also included a significant information and technology transfer component through two beaver workshops worked on specifically through this project. SWQB also partnered in a third beaver workshop that resulted in a training DVD.

The Rio de las Vacas, through this project, is moving towards a naturally functioning, self-sustaining wetland ecosystem because it is improving conditions for beaver, the most natural wetland engineer. Improving riparian habitat will encourage beaver to return and help sustain the project. We are addressing the impacts from the grazing component; however, sustainability can only occur with buy-in from the people who use the area. This is the reason for the workshops, so that recreational, grazing and other uses of the land will not discourage the presence of beaver.

Start and end dates (dates can overlap – estimates are acceptable):
October 2005-October 2008

- **Planning:** Not specified.
- **Implementation:** Not specified.
- **Monitoring:** Not specified.

Cost – Financing (estimates are acceptable):

Funding (Federal and Final Match Balances)
Grant Award Federal funding –

- EPA 152,335
- Match 50,793
- Drawdown FY 06 0.00 100.00
- Drawdown FY 07 7,215.00 15,000.00
- Drawdown FY 08 27,871.00 26,250.00
- Drawdown FY 09 45,586.00 20,300.00
- Drawdown FY 10 2,769.04 13,348.00
- Drawdown FY 11 68,883.33 0.0
- balance 10.63 (24,205.00)

- **Planning:** Not specified.
- **Implementation:** Not specified.
- **Monitoring:** Not specified.
- **Continual (are there ongoing maintenance costs that will be required?):** Not specified.

Resulting benefits (please list what was measured and how:

- Water quality improvements
- Wetland restoration
- Biodiversity/productivity

- Public access, recreation, awareness

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.):
Implementation of this project included increases in area of riparian and spring wetlands, more pools in the river, less erosion, improved shade, increased meanders, sinuosity and channel length, and restored streambank to begin planting wetland/riparian vegetation. The improved wetlands and riparian corridor will provide a buffer protecting water quality on the Vacas. The restoration will also improve shade and increase the number of pools in the rivers, which are issues of concern for the SFNF and SWQB. As the wetlands improve, so will habitat for fisheries, amphibians and mammals, especially the beaver. Creating a more resilient habitat will improve the function of the stream increasing biodiversity as well as allow for traditional uses such as grazing. The watershed will become more productive and with proper management can become a "win-win" situation. Specifically, improved habitat will increase populations for state and Federal listed species: Rio Grande cutthroat trout and New Mexico jumping mouse. The project also improved habitat for Rio Grande Chub and Rio Grande sucker and most importantly the beaver.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):
Hemi-enclosure fences are riparian fences that protect only the landward side of the streambank. The 20 hemi-enclosure fences installed as part of this project minimize costs of construction and maintenance and reduce the likelihood of damage from flooding or vandalism while protecting vegetation from grazing animals, especially cattle.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
The Rio de las Vacas is very popular as a destination for recreation activities. It is the home waters for a popular fishing organization, New Mexico Trout, and is well known as a destination for fish enthusiasts. There are over 30 miles of trails and the terrain is gentle enough for idyllic horseback rides or bicycling. There are at least 3 officially developed campgrounds, although dispersed camping does occur. Hunting also occurs in season.

Other: No information provided.

Are benefits based on actual measures or did you use a model to predict benefits? No information provided.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response): No information provided.

If you do not have any data currently available in regard to benefits, how do you plan to measure them? No information provided.

Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe):

The hemi-enclosure was a new technique conceived and designed by Bill Zeedyk, Zeedyk Ecological Consulting, Inc. to protect riparian areas from grazing and trampling and minimizing our costs of ever inflating price of metal. The style of fence has advantages over traditional enclosures because they are economical, shorter in length and will require less maintenance especially crossing the stream. Observation shows that riparian and wetland vegetation is the first to 'green up' in the spring and provide nutrients to grazing animals including smaller species such as rabbits and prairie dogs. The wetland/riparian components are often grazed heavily if there isn't any management to move stock. Enclosures, whether they are large as in pastures, or riparian restoration boxes, function to protect riparian/wetland vegetation thereby strengthening the stream banks. This type of fence protection requires maintenance since the fence crosses the river two places. The 'hemi- enclosure fence' takes advantage of the cow behavior to only forage on the terrace side of the river. We fenced the outside curve on a meander. Pools develop on the inside curve of the meander if the stream banks are stable. By protecting the riparian component, the pool has increased shade and bank stability.

Another important component of the project, the beaver workshops were innovative because many New Mexico landowners view beavers as a nuisance. Disseminating information about the positive benefits of beavers and practical ways to coexist with beavers served to create momentum for beaver habitat projects. The workshops cast a positive light and changed some attitudes about beavers. This project contributed progress towards achieving the following approved SWQB Wetland Program Plan objectives:

1. Develop two new restoration sites per year and demonstrate innovative designs and techniques for restoring wetlands. A project to continue work in this area was approved for CWA §319 (h) funding in FY 2012. Using hemi-enclosure fences and natural channel design we demonstrated as successful new and innovative process for restoration on this stream.
2. Create technical materials and disseminate information to private landowners, tribes, and others on incentives, methods and trainings to restore and protect wetlands, and coexist with beaver.

Lessons Learned:

This project was a delight to work on the ground, but there never seemed to be enough time to take care of all the details, including the reports. Staff has spent many hours working with private landowners, but the end result was that some did not wish to participate due to potential or perceived limitations on how their land was managed. Some were outright uninterested in restoring their land. Others, while passively interested did not want to participate in helping with the required permits. We are hoping that the neighbors have followed the process used in the SFNF public land. As the land becomes more productive and healthy, they may wish to improve their lands. It was also an important lesson to keep communication open with the Cuba Ranger District, especially Range staff, to address trespass cattle issues. The ability to compromise has been our biggest asset in moving forward with this project.

Do you have any images or photos to share?

Cattle grazing on the flood plain of the Rio de las Vacas. Note lack of riparian species.

Coexisting with Beavers by Preventing Damage Workshop participants

Turkey Canyon springs. One rock dam

Mini-enclosure in upper reach

FMI (please include contact name, organization, website, phone number and/or email address):

Maryann McGraw
Environmental Scientist-Supervisor
Wetlands Program Coordinator
New Mexico Environment Department
Surface Water Quality Bureau
1190 St. Francis Drive, Rm 2059 N
P.O. Box 5469
Santa Fe, New Mexico 87502-5469
Phone: 505-827-0581
FAX: 505-827-0160

YAKIMA RIVER BASIN WATERSHED PROJECT INVENTORY DATA SHEET

Name and location of watershed:
Yakima River Basin in Washington

Size of watershed (in acres):
3,936,000 acres

Title of Project/Initiative:
Yakima River Basin Integrated Plan

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
- X Rural (anything outside the urban area)
- X Inland
- __ Coastal

Need/Challenge Addressed (200 word limit):
The Yakima Basin Integrated Water Management Plan is a commonsense approach to solving water conflicts in the Yakima River Basin. It offers a 30-year vision for responding to drought and changing climate, assuring water is clean and ample, and lands are both protected and productive for growing communities and the natural environment. It was developed by Reclamation and the Washington State Department of Ecology in conjunction with the Yakama Nation and Yakima River basin stakeholders.

The Integrated Plan lays out three phases, each about a decade long, and each phase balanced to move all interests forward. As a whole, the plan includes making better use of existing water supplies and water infrastructure, increasing water storage, creating fish passage at Bureau of Reclamation reservoirs, and restoring and enhancing habitat. Parts of the Initial Development Phase (IDP) are now underway using existing authority. Federal authorizing legislation and appropriations are needed for critical elements of this first phase, including the first water supply project.

Goals & Objectives (please include ecosystem services/values focused on):
The goals of the YBIP are to protect, mitigate, and enhance fish and wildlife habitat; provide increased operational flexibility to manage instream flows to meet ecological objectives, and improve the reliability of the water supply for irrigation, municipal supply and domestic uses. All YBIP projects align with seven elements designed to work together. Many projects provide benefits for both water supply and ecosystem restoration. Each of YBIP's three 10-year phases contain a balanced mix of the seven elements, ensuring that all stakeholder interests are addressed.

- Fish passage
- Fish habitat enhancement
- Modifying existing irrigation structures and operations
- Surface storage
- Water market-based reallocation (water banks)
- Groundwater storage

- Enhanced water conservation

Overall Strategy (i.e., what role do wetlands play in your project?)

- Restore salmon and steelhead populations from under about 25,000 today to 300,000 by improving fish passage into the Yakima Basin's headwaters and restoring river and stream habitat
- Conserve up to 170,000 acre feet of water through irrigation system upgrades
- Institute a robust water market during drought years to equitably move water from low to high value uses
- Enhance water storage to make up for a declining snowpack due to climate change, beginning with a small pool raise at Cle Elum Reservoir and the installation of a drought year pump to access more stored water in Kachess Reservoir
- Protect 70,000 acres of private land, including over 50,000 acres in the Teanaway River watershed that were acquired by the State of Washington as the first major action under the Yakima Plan in 2013
- Enhanced protection for over 160,000 acres of federal land and about 200 miles of new Wild and Scenic rivers, starting with Wild and Scenic designation of the upper Cle Elum River system

Techniques Used (please check all that apply):

X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

__ Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** Washington State Dept. of Ecology, US Bureau of Reclamation
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** American Rivers, The Wilderness Society, Trout Unlimited
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Yakima River Basin workgroup, Yakima Nation, regional irrigation districts, environmental organizations.

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Yakima Nation, in addition to nearly 400,000 people live within the Yakima River Basin, and the basin supports $4.5 billion in the agriculture growing and processing industry. The Yakima River Basin

stakeholders have competing demands, interests, and values, which set the stage for conflicts over water that are often controversial. These complex problems at the interface of people and nature require farmers, scientists, tribal members, federal agencies, the public, and decision makers to come together to build consensus, negotiate tradeoffs, and make decisions across a rapidly changing landscape. Understanding issues at a watershed scale involves complexity, and the stakeholders relying on the Yakima River Basin for water have varying needs of the natural resources in the region. The Yakima River Basin Integrated Water Resource Plan works to incorporate these needs through stakeholder working groups, public forums, EIS processes, and feedback.

Overview/history (200 word limit):

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative? Please describe.

After a devasting drought in 1977, Congress directed the Bureau of Reclamation to work with the State of Washington to conduct studies and develop a plan to provide water for irrigation, treaty rights, aquatic life and fish habitat. This effort was titled the Yakima River Basin Water Enhancement Program (YRBWEP). Early studies identified fish passage issues. The Hoover Power Plant Act of 1984 authorized fish passage facilities through the Yakima basin, partially funded by the Bonneville Power Administration. YRBWEP designed and enacted fish passage basin wide.

After the 1992-1994 drought, legislation authorized water conservation and instream flow projects. Costs for water conservation are shared by Reclamation, the Washington Dept. of Ecology and irrigators. Two-thirds of irrigation water conserved remains instream to help with flows, while one-third is retained by irrigators for use in drought years. Following another drought in 2005, Reclamation and Ecology built on YRBWEP 1 and 2 by creating a stakeholder workgroup to address other elements of water supply and fisheries issue. In 2009, this group began developing the Yakima Basin Integrated Plan (YBIP), a watershed-scale approach to sustainable water supply for fish, families, farms and forests.

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness.

Completed Initial Development Phase Projects:

<u>Surface Water Storage</u>

- Kachess Drought Relief Pumping Plant - Draft EIS.

<u>Structural and Operational</u>

- Keechelus to Kachess Conveyance - Draft EIS.
- Cle Elum Pool Raise – Modify Cle Elum Dam radial gates which, when coupled with shoreline protection, will increase storage by14,600 acre feet.

<u>Agricultural Water Conservation</u>

- Three Miles of Roza Irrigation Canal sealed – Prevents seepage of 1,300 acre feet annually.
- Manastash Creek Consolidated Pipeline – Piped canal, 1,095 acre feet of water annually.
- Anderson Diversion Irrigation Water Acquisition – 894 additional acre feet saved through Manastash Consolidated Pipeline sold to Ecology's Trust Program for instream flows.
- Sprinkler Conversion Project – 154 acres of rill irrigation converted to efficient sprinklers.
- WIP Lateral Piping – Piped canal irrigating 476 acres, saves users 840 acre feet annually.

- WIP East Satus Lateral Piping – Piped 6,600 feet of canal, saves 780 acre feet annually.
- Kennewick Irrigation District Diversion Lining – Lined 1.1 miles of open canal.

Groundwater Storage

- City of Yakima Aquifer Storage Recovery – Completed construction on new aquifer storage and recovery facility in March 2015.

Market Reallocation

- Kittitas County Water Bank – Kittitas County launched new water bank to offset $ groundwater wells with senior water rights in December 2015

Fish Passage

- Cle Elum Fish Passage Phase I and Phase II – Construction of access road, bridge, and secant pile vault.
- Tieton-Rimrock Fish Passage – Study of alternative passage systems.

Habitat Enhancement

- Teanaway Community Forest – 50,241 acres of forested headwaters protected as Washington's first community forest.
- Cle Elum Side Channel Restoration – Reconnected 7 miles of streams, 300 floodplain acres.
- Teanaway Floodplain – Placement of woody debris reconnects creek with floodplain.
- Reed Diversion Removal – Dam removal reopened access to 20 miles of fish habitat.
- Coleman Creek Project – Old diversion replaced with fish screen and bypass into creek.
- Little Rattle Snake Road Decommission – Five miles of road regraded and 2,470 native plants planted in old roadbed and stream bank to reduce sediment runoff.
- Gap to Gap Outfall Relocation – Reconnected 1,000 acres of floodplain by relocating waste treatment plant outfall.
- KRD Tributary Supplementation - Using irrigation canals to rewater tributaries.

Start and end dates (dates can overlap – estimates are acceptable):

- Planning: 2009-2013
- Implementation: Initial Development Phase 2013-2023; Phase 2 2024-2034; Phase 3 2035-2045
- Monitoring: No information provided.

Cost – Financing (estimates are acceptable):

- **Planning:** No information provided.
- **Implementation:** Full Development Costs for- Habitat/Watershed Protection and Enhancement $480,500,000; Fish Passage (6 projects) $428,400,000; Surface Water Storage $2,416,500,000; Regional and Municipal Water Storage $123,200,000; Structural/Operational Changes $127,150,000; Enhanced Water Conservation $429,500,000; Market Driven Reallocation $2,950,000, Integrated Plan Update Costs $3,000,000
- **Monitoring:** No information provided.
- **Continual (are there ongoing maintenance costs that will be required?):** No information provided.

YBIP is predicated on an innovative federal-state-local-private funding partnership, which provides a collaborative model for other water projects:

- The irrigation districts propose to finance, construct and operate KDRPP, which will remain a part of Reclamation's Yakima Project.
- The State of Washington agreed to pay for up to half of the project and has already invested $205.9 million directly in YBIP through mid-2019.

Investment in YBIP, YRBWEP II and related projects is growing. The combined investment of the Yakama Nation, irrigation districts, three counties and conservation groups is at least $39.6 million since 2013. The basin has received approximately $218 million from federal sources since 2013, derived from agencies including: Reclamation, BPA, USFS, NOAA Fisheries, NRCS, BIA, USFWS, BLM and USACE.

Resulting benefits (please list what was measured and how:

- Water quality improvements
- Hydrological conditions
- Public access, recreation, awareness
- Agricultural activity
- Habitat protection
- Irrigation
- Drought prevention

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.):
The estimated annual value of ecosystem services provided by the Basin's freshwater, wetlands, grasslands, and forests ranges from $350 million to $15 billion

Yakima River salmon and steelhead have recovered from 3,000 returning fish in the mid-1990s to about 50,000. Fish passage at Reclamation's reservoirs, along with other YBIP improvements, could increase fishery runs to 300,000, which would support recreation and address federal treaty obligations to the Yakama Nation.

Improved streamflow regime in many key reaches of the Yakima River, Naches River, and tributaries with storage facilities. This includes improved ability to meet flow objectives in 13 of 15 reaches of the mainstem Yakima River, as well as improved "carryover" water in storage at the end of most irrigation seasons. Carryover water provides improved system flexibility for meeting streamflow objectives in the following water year.

Improved water supply reliability for three irrigation divisions that rely heavily on "portable" water rights, primarily for agricultural irrigation. These are the Kittitas Reclamation District, Roza Irrigation District, and Wapato Irrigation Project. Drought conditions have occurred an average of once every 4 years in the last 20 years, reducing supplies to as low as 37 percent of entitlements. The plan is expected to increase available supplies to at least 70 percent of water entitlements to these users during dry years.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):
The Yakima River Basin's agricultural economy generates $4.5 billion and 44,300 jobs. Total tourism spending in the Basin is over $870 million and accounts for 14,200 jobs. The YBIP works to protect these vital contributions to Washington State's economy through more reliable and sustainable water supplies.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
Outdoor recreational expenditures in the YRB in 2015 exceeded $1.2 billion, and unquantifiable cultural and spiritual values of Salmon and Steelhead to the Yakima Nation.

Other: No information provided.

Are benefits based on actual measures or did you use a model to predict benefits? Combination of both were used to assess outcomes of completed projects as well as cumulative benefits of this 30-year plan. The Integrated Plan includes evaluations of water supply and streamflow outcomes from a detailed hydrologic model of the Yakima basin. Fish production was modeled using the Ecosystem Diagnosis and treatment (EDT) model, the All H4 Analyzer (AHA) model, and the Euphotic Zone Depth (EZD) model.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response)
A 2012 analysis of YBIP economics as a programmatic whole found an overall benefit-cost ratio of between 1.4:1 and 3.2:1. In 2012 dollars, the most probable cost was estimated at $4.2 billion (range - $3.2 to $5.4 billion) with a present value of $3.12 billion. Under federal practice, each of YBIP's three major water projects will be subject to a project level economic analysis and environmental review prior to construction.
https://www.usbr.gov/pn/programs/yrbwep/reports/fouraccounts.pdf

If you do not have any data currently available in regard to benefits, how do you plan to measure them?
No information provided.

Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? If so, please describe:
The Yakima River Basin Integrated Water Management Plan builds on decades of work to achieve water security that began in the 1980s through the federal Yakima River Basin Water Enhancement Project. Years of litigation and successive droughts brought irrigation districts, environmental organizations, the Yakama Nation, and federal, state, county, and city governments to the table to form the Yakima River Basin work group to develop the plan. In 2013, the Legislature recognized the need to find sustainable water solutions that meet both instream and out-of-stream benefits in the region by authorized funding for the initial development phase of the Yakima Basin Integrated Plan.

Lessons Learned: No information provided.

Do you have any images or photos to share?

FMI (please include contact name, organization, website, phone number and/or email address):
TBD, Listed as:
Tim Poppleton
Office of Columbia River web coordinator
tim.poppleton@ecy.wa.gov
509-454-4241

Websites & Documents

- ArcGIS: The Yakima Basin Integrated Plan
- WA Department of Ecology: The Yakima Basin Integrated Plan
- Yakima River Basin Integrated Water Resource Management Plan
- YBIP Primer
- Yakima Basin Integrated Plan Status and Updates
- www.yakimariver.org/

DELAWARE RIVER BASIN WATERSHED PROJECT DATA SHEET

Name and location of watershed: Delaware River Basin, located in New York, New Jersey, Pennsylvania, and Delaware

Size of watershed (in acres): 8,664,960 acres

Title of Project/Initiative: Delaware River Watershed Initiative

Setting: (please check all that apply)

- X Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
- X Rural (anything outside the urban area)
- X Inland
- X Coastal

Need/Challenge Addressed (200 word limit):

The Delaware River system is the lifeblood of the Mid-Atlantic, supplying drinking water and jobs for millions of people across four states. The Delaware River Watershed Initiative (DRWI) is a large-scale, collaborative program that is taking action to maintain and improve the quality of aquatic ecosystems within the Delaware River Basin. The initiative's components include on-the-ground restoration projects, strategically targeted land protection, public outreach regarding water quality issues, coordination of professional and citizen-based monitoring groups, and sharing data and ideas to measure the changes in aquatic communities over time as a result of these efforts. DRWI is focused on four key stressors that threaten the health of our waterways, and the safety and reliability of our drinking water.

Loss of Forested Headwaters: The Delaware Basin is home to eight million people, and growing, but sprawl is threatening the forests that filter our water.

Agriculture Runoff: Rain running off fields can carry manure, fertilizer and pesticides into our rivers, polluting the places we like to boat, swim, and fish, while contaminating our drinking water.

Stormwater: As pavement replaces plants, rain flows into rivers rather than seeping slowly into the ground. Along the way, it picks up motor oil, road salt, antifreeze, and other pollutants.

Depletion of Groundwater: Millions of people rely on water from the Kirkwood-Cohansey aquifer in southern New Jersey, but this vast freshwater reserve is over tapped, draining wells and wetlands.

Goals & Objectives (please include ecosystem services/values focused on):

Clean Water for Millions

By protecting forests at the headwaters of the Delaware River and its tributaries, we can safeguard the drinking water source for 15 million people in four states.

Green and Livable Communities

The trees and plants that filter polluted runoff also beautify our neighborhoods, increase property values, and reduce flooding and erosion.

River Friendly Farms
Farmers are making smart choices to reduce fertilizer and pesticide pollution, keep fertile soil on the land, and shade and clean nearby streams.

Overall Strategy (i.e., what role do wetlands play in your project?)
The Delaware River Watershed Initiative aligns with over 50 organizations to scale up their impact and accelerate the protection of important landscapes, restoration of degraded areas, and adoption of green infrastructure and responsible farming practices. The Initiative focuses on eight targeted areas: the Poconos-Kittatinny Cluster, the Upper Lehigh Cluster, the New Jersey Highlands Cluster, the Middle Schuylkill Cluster, the Schuylkill Highlands Cluster, the Upstream Suburban Philadelphia Cluster, the Brandywine-Christina Cluster and the Kirkwood-Cohansey Aquifer. Project results are tracked via ongoing monitoring at more than 300 locations across the basin. Of the 8,664,960 acres that make up the Delaware River Basin, wetlands cover approximately 700,000 of those acres. To ensure the Delaware River system can provide clean drinking water to all for generations to come, conservation groups and community partners are focused on three solutions:

Land Protection: Protecting open space from development keeps rivers and streams healthy. By keeping green spaces green, we ensure that rivers and streams run pure and clean today and for generations to come.

Stormwater Solutions: Preventing polluted runoff from contaminating our rivers and streams also protects our drinking water. Naturescapes, like rain gardens and streamside forests, clean streams while greening our communities.

Farmland Restoration: Farmers care deeply for their land, and when they manager their farms with clean water in mind, they can save money, keep fertile soil on the farm, and reduce pollution downstream.
Additional Strategies Include: Collaborative and Shared Learning, Community Engagement, and Floodplain Restoration.

Techniques Used (please check all that apply):

- X Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)
- __ Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)
- __ Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)
- X Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** The William Penn Foundation (WPF), Open Space Institute (OSI), National Fish and Wildlife Foundation (NFWF)
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Academy of Natural Sciences (ANS)
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Institute for Conservation Leadership (ICL)

Project Partners:

The Poconos-Kittatinny Cluster: Brodhead Watershed Association, Delaware Highlands Conservancy, East Stroudsburg University, Natural Lands, Orange County Land Trust, Pinchot Institute for Conservation, Pocono Heritage Land Trust, The Nature Conservancy–Pennsylvania.

The Upper Lehigh Cluster: Audubon Pennsylvania, Natural Lands, North Branch Land Trust, North Pocono Care, Poconos Heritage Land Trust, The Nature Conservancy of Pennsylvania, Wildlands Conservancy

The New Jersey Highlands Cluster: Association of New Jersey Environmental Commissions, Hunterdon Land Trust, Musconetcong Watershed Association, New Jersey Audubon, New Jersey Conservation Foundation, New Jersey Highlands Coalition, North Jersey Resource Conservation & Development, Sussex County Municipal Utilities Authority–Wallkill River Watershed Management Group, The Land Conservancy of New Jersey, The Nature Conservancy of New Jersey, Trout Unlimited.

The Middle Schuylkill Cluster: Berks Nature, Partnership for the Delaware Estuary, Stroud Water Research Center.

The Schuylkill Highlands Cluster: Audubon Pennsylvania, Berks Nature, French and Pickering Creeks Conservation Trust, Green Valleys Watershed Association, Natural Lands, Partnership for the Delaware Estuary, Stroud Water Research Center.

The Upstream Suburban Philadelphia Cluster: Darby Creek Valley Association, Eastern Delaware County Stormwater Collaborative, Friends of the Poquessing Watershed, Lower Merion Conservancy, Pennsylvania Environmental Council, Pennsylvania Resource Council, Pennypack Ecological Restoration Trust, Philadelphia Resources Council, Temple University, Tookany/Tacony Frankford Watershed Partnership, Villanova Urban Stormwater Partnership, Wissahickon Valley Watershed Association.

The Brandywine-Christina Cluster: Brandywine Conservancy & Museum of Art, Brandywine Red Clay Alliance, Natural Lands, Stroud Water Research Center, The Nature Conservancy of Delaware, University of Delaware Water Resources Agency.

The Kirkwood-Cohansey Aquifer: American Littoral Society, Association of New Jersey Environmental Commissions, Natural Lands, New Jersey Audubon, New Jersey Conservation Foundation, Partnership for

the Delaware Estuary, Pinelands Preservation Alliance, Rutgers University, South Jersey Land and Water Trust.

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): 15 million people rely on the Delaware River Watershed as a resource. Over 40 organizations are involved in the DRWI.

Overview/history (200 word limit):
In consultation with leading-edge researchers, the DRWI identified eight priority areas where restoration and protection projects can have a lasting impact. These priority locations include parts of the pristine headwaters and working forests of the upper watershed, farmlands, suburbs, and industrial and urban centers downstream, and the coastal plain where the river empties into Delaware Bay. The eight priority areas include:

- The Poconos-Kittatinny Cluster
- The Upper Lehigh Cluster
- The New Jersey Highlands Cluster
- The Middle Schuylkill Cluster
- The Schuylkill Highlands Cluster
- The Upstream Suburban Philadelphia Cluster
- The Brandywine-Christina Cluster
- The Kirkwood-Cohansey Aquifer

How many individual projects are currently being implemented or are planned to be implemented within this broader watershed initiative?

- 40 Restoration projects will reduce polluted runoff, flood risk and erosion, and help rivers and streams run cleaner.
- 30,000 Acres of protected forests will preserve clean water, provide habitat for fish and wildlife, and buffer the effects of climate change.

Is there a track record of past, completed projects in this watershed? If yes, please describe and provide available information regarding performance/effectiveness.
Accomplishments to date:
The Poconos-Kittatinny Cluster: In the past four years, the partners have initiated projects that will conserve more than 9,000 acres of land and monitored 42 sites for water quality. Thirty-one municipalities benefited from zoning and ordinance assessments. Four municipalities moved towards revising codes to protect water quality. Partners also facilitated a successful $2 million municipal open space bond initiative and secured $450,000 to help landowners implement conservation-friendly practices on their lands.

The Upper Lehigh Cluster: The partners have initiated projects that will conserve 1,600 acres of forestland. The groups are also working to engage municipalities in conservation planning initiatives. An extensive effort to monitor water quality at more than 50 locations throughout the region was launched in 2014

The New Jersey Highlands Cluster: The partners have initiated projects that will protect 2,600 acres of land. They have restored 930 acres and monitored 26 sites for water quality. They developed tools to calculate the costs of floodplain development, track microbial pollutants, and provide guidance on easements and stewardship to help conservation organizations and municipalities. The groups plan a regional conference to showcase projects, explore new concepts, and promote a watershed ethic compatible with development. The groups also nurtured partnerships with public and nonprofit agencies that they will leverage in the coming years.

The Middle Schuylkill Cluster: Middle Schuylkill groups and their partners have worked with dozens of farms, installing best management practices on 3,000 acres of land, including riparian forested buffers on almost 100 acres. They have also monitored 15 sites for water quality. Demonstrations and educational programs reached more than 1,500 students and adults in 2017 alone, and 18 adults have completed training to become Berks Nature Ambassadors.

The Schuylkill Highlands Cluster: The partners have initiated projects that will protect 508 acres of land and monitored 50 sites for water quality, building on a legacy of conservation work that has already preserved more than 40,000 acres in the region, including land in and around beloved landmarks such as the Hopewell Big Woods (the largest unbroken expanse of forest left in southeastern Pennsylvania), French Creek State Park, and Hopewell Furnace National Historic Site.

The Upstream Suburban Philadelphia Cluster: Partners have restored riparian buffers, stabilized or restored stream banks, and monitored 108 sites for improvements in water quality. More than 300 volunteers have been trained as stream monitors, and thousands of citizens have donated nearly 9,000 hours at clean-ups, plantings, and educational events.

The Brandywine-Christina Cluster: The partners have protected 19 farms encompassing 1,244 acres with 9 miles of streams, planted 34,507 trees to create 22.35 miles of forested stream buffers, installed 8.75 miles of stream bank fencing, and implemented 185 agricultural best management practices on 44 farms. They monitored 46 sites for improvements to water quality. The partners also secured the adoption of six riparian buffer ordinances by local municipalities.

The Kirkwood-Cohansey Aquifer: Over the past four years, the partners initiated projects that will preserve nearly 5,000 acres and restored almost 2,500 acres. Partners also analyzed aquifer capacity and stream flow and worked with communities to implement water conservation practices. In addition, 44 sites were monitored for water quality.

Start and end dates (dates can overlap – estimates are acceptable):

- Planning: Information not provided.
- Implementation: 2014-Present
- Monitoring:2014-Present

Cost – Financing (estimates are acceptable):

- **Planning:** Information not provided.

- **Implementation:**
    - $30 million per year from WPF
    - $7 million from NFWF
    - $9 Million from OSI
- **Monitoring**: Information not provided.
- **Continual (are there ongoing maintenance costs that will be required?):** Information not provided.

Funding Sources:

The Poconos-Kittatinny Cluster: Partners will work with local leaders to assess opportunities for municipal open space bond measures. A "1% for Nature" program will give customers of local businesses the opportunity to make voluntary contributions that help protect land in Monroe County.

The Upper Lehigh Cluster: The partners are leveraging a William Penn Foundation grant and working with other foundations, public agencies, businesses, and individuals to raise almost $28 million for permanent land and stream protection. A new "1% for Nature" fund will seek contributions from businesses for watershed protection.

The New Jersey Highlands Cluster: The partners have identified $17 million in state, county, local, and private matching funds for protection, restoration, and other initiatives to augment support from the William Penn Foundation; the match will be 12:1.

The Middle Schuylkill Cluster: The partners are leveraging a William Penn Foundation grant and working with other foundations, agencies, businesses, and individuals to raise $4.5 million to $7 million for best management practice implementation, outreach materials, and demonstration project materials.

The Schuylkill Highlands Cluster: The conservation partners seek to raise $10 million to supplement $1.8 million from the William Penn Foundation. Public and private sources include grants and financing through municipal and county open space programs, the Schuylkill River Restoration Fund, and federal and state agencies.

The Upstream Suburban Philadelphia Cluster: The partners seek $3.8 million in funds from public and private sources, including from towns, the Commonwealth of Pennsylvania, federal agencies, and the contributions of homeowners and sweat equity of volunteers.

The Brandywine-Christina Cluster: The partners are seeking to raise more than $9.7 million in funding from public and private sources, beyond the grant from the William Penn Foundation. A proposed new conservation funding mechanism—the Brandywine-Christina Healthy Water Fund, through which the watershed's downstream beneficiaries will invest in upstream land restoration and protection measures that ensure water quality—is projected to bring in an additional $1 million to $10 million. The fund will initially be managed by The Nature Conservancy with technical support by the University of Delaware Water Resources Center and guidance from all partners.

The Kirkwood-Cohansey Aquifer: Partners anticipate leveraging $18 million from federal agencies, such as the USDA Natural Resources Conservation Service; state agencies, such as the Department of Environmental Protection's Green Acres Program and the New Jersey Pinelands Commission; and donations from private foundations and individuals.

Resulting benefits (please list what was measured and how:

- Water quality improvements
- Wetland restoration
- Public access, recreation, awareness
- Filtration of polluted runoff

Environmental benefits (e.g. water quality improvements, habitat protection or improvement, reduced phosphorus and nitrogen loads, etc.):
Environmental benefits from DRWI projects include: permanently protect forested land, streams and headwaters, reestablish riparian buffer, restore wetlands, prevent degradation of streams, partner with landowners to develop new forest management plans or adopt conservation practices, update municipal ordinances or land-use planning documents to protect water quality, restore stream hydrology, implements green stormwater infrastructure and control measures to reduce nutrient, sediment, and bacterial pollution, reduce flooding.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):
An estimated $25 billion in annual economic activity is generated across the watershed.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
Additional benefits of DRWI projects include: training citizen scientists, developing demonstration projects, and conducting outreach campaigns for residential landowners which help build awareness of water quality issues and support the restoration work.

Other:

Projected Outcomes:
The Poconos-Kittatinny Cluster: The partners aim to protect 10,000 acres of forested land over the next three years. Restoration activities on protected lands will reestablish at least one mile of forested riparian buffer and restore 60 acres of wetlands. At least 60 landowners will develop new forest management plans or adopt conservation practices. Eight towns will update their ordinances or land-use planning documents to protect water quality

The Upper Lehigh Cluster: Over the next three years, the partners anticipate protecting 5,400 additional acres of forest and another 21 stream miles. These actions will slow the loss and fragmentation of forestland and prevent degradation of streams.

The New Jersey Highlands Cluster: The conservation groups expect to permanently protect 2,600 acres of forested land and 12 miles of forested stream buffers. They will restore or enhance another 3,800 acres, restore 4.5 miles of forested riparian buffers, restore 8.2 miles of stream hydrology, and treat 5.5 acres with green stormwater infrastructure. The partners plan to help 13 municipalities conform to the Highlands Water Protection and Planning Act requirements and will work with several others to improve their codes and ordinances relating to stormwater and land protection.

The Middle Schuylkill Cluster: In the next three years, the partners aim to implement best management practices on 7,300 acres of farmland. They will also help two poultry operations, three schools, and 15 water and sewer authorities adopt practices that safeguard water quality. Training citizen scientists, developing demonstration projects, and conducting outreach campaigns for residential landowners will build awareness of water quality issues and support the restoration work.

The Schuylkill Highlands Cluster: Over the next three years, the partners will permanently protect 2,900 headwater acres and 8 stream miles. Restoration practices will be implemented on 325 acres of farmland and 10 urbanized acres that cause stormwater runoff. Riparian and other critical habitat will be restored on 57 acres of private land, and three municipalities will upgrade ordinances and plan or implement green stormwater infrastructure.

The Upstream Suburban Philadelphia Cluster: Stream restoration efforts (nine projects restoring three stream miles) and stormwater control measures (40 projects treating 739 acres) will reduce nutrient, sediment, and bacterial pollution; reduce the volume and velocity of runoff; and reduce flooding after heavy rains. Success will build urban communities' support for future initiatives.

The Brandywine-Christina Cluster: Seventeen farms covering 890 acres will be permanently protected from development, and 10.5 miles of streams will be buffered. A full suite of agricultural management practices are expected to be implemented on 41 farms. Approximately 1.5 miles of streams are targeted for restoration. Dozens of municipalities will receive planning and technical assistance.

The Kirkwood-Cohansey Aquifer: The partners anticipate protecting almost 3,000 acres of forestland. Agricultural conservation practices will be implemented on 2,800 acres. Green stormwater infrastructure and pollution prevention practices will treat nearly 70 developed acres. Water efficiency measures, paired with efforts to prevent increased groundwater withdrawals, will improve aquifer recharge. Together, the projects will protect nature, safeguard farmland, and restore lands damaged by aquifer depletion and poor management.

Are benefits based on actual measures or did you use a model to predict benefits?
Both actual measurements and models are used to predict and monitor benefits. When possible, baseline measurements were secured through partner agencies and organizations.

Data collected for project-specific monitoring includes the number of acres preserved, damaged habitats restored, per capita water usage in the focus areas, and individuals participating in outreach and engagement projects. In many cases, impacts on water table levels, water chemistry and biological communities will be difficult to measure directly. These assessments require advanced professional expertise because these

projects relate to a large area and either the effects of any given action may take years to develop or it may not be possible to isolate the effects of the project from a "noisy" natural system.

In some cases, however, the nature of a project lends itself to direct measurements. In such cases, it will be appropriate to monitor acidity, aquatic plant and fish communities, nitrogen and phosphorous levels, and aquifer withdrawals. Although complex, efforts to define and implement an effective monitoring plan for the aquifer can be a powerful organizing tool to galvanize improved protections for the groundwater that supports these unique landscapes.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response): Information not provided.

If you do not have any data currently available in regard to benefits, how do you plan to measure them? Information not provided.

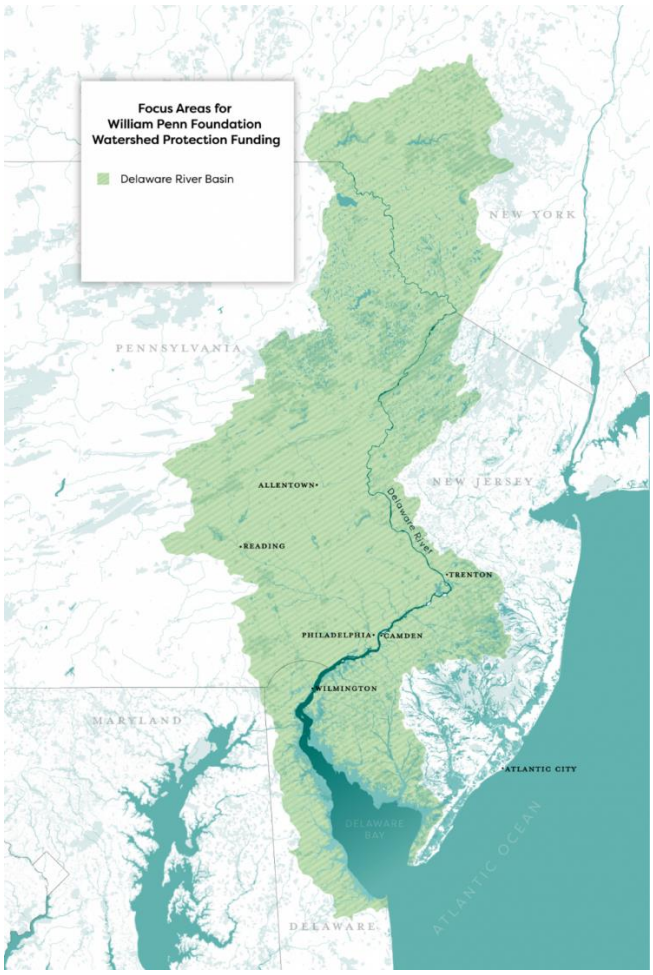
Were there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe)
The New Jersey Highlands Cluster: Incentives in the Highlands Water Protection and Planning Act (which encourages certain zoning policies and 300-foot-wide stream buffers) will create additional opportunities for protection and restoration.

The Upstream Suburban Philadelphia Cluster: The project team will develop a suite of tools that will engage citizens in monitoring. For example, a web-based, interactive map will invite direct public input, including pictures, comments and project profiles, and enable the sharing of project information through social media. A smartphone app will allow citizens to submit monitoring data in a standardized form or simply view project information; the app will link with specific monitoring sites by placing a Quick Response (QR) Code on signage in the field. The cluster team will offer a robust training program to recruit volunteers and strengthen their monitoring programs.

Lessons Learned:
"No single organization can do it by itself. The power of us all working together is what makes the difference." Jack Stefferud, Natural Lands Trust – *A Watershed Moment*

Promoting consistency among municipalities in policies that affect water resources, including ordinances on riparian buffers and steep slopes.

Do you have any images or photos to share?



FMI (please include contact name, organization, website, phone number and/or email address):

- https://4states1source.org
- A Watershed Moment

Appendix F: Capturing the Value of Integration

Capturing the Value of Integration

Considering Benefit-Cost Measures When Making Decisions about Integration Activities

Association of State Wetland Managers - March 2019

Background: Many environmental problems, including wetland issues, are complex and multifaceted. They require the efforts of many different systems working together to be resolved. Integration can extend reach, strengthen the end-product, create greater efficiencies and cost-savings. It can also provide new, more effective and sustainable opportunities. Before undertaking an integration project, states and tribes may need to be able to show that it is a good investment. This information about Return on Investment (ROI) may be needed in order to compete with other requests for the same funds, to show that others have made integration work in similar circumstances or to be able to point to successful peer examples where their outcomes showed integration had greater benefits than costs. ASWM has developed this brief factsheet to share project findings around integration benefit and cost measures to meet this need.

From Concepts to Shareable Spreadsheet Analysis: In order to analyze the true costs and benefits of an integration project, planners should engage an expert in benefit-cost analysis. However, there are some basic concepts that non-experts can consider when thinking about integration. The first step in this process is understanding the goals of your analysis - What are your trying to measure? What measures will you use? Once you know which measures, you will need to create a formal measure to capture this information (a process called "operationalization"). There are many specific measures available to help your team capture your integration projects' costs and benefits. Some specific considerations that require expert advice include how to ensure there is no double-counting (values of the same benefit attributed more than once to the totals).

ASWM's research indicates that states and tribes often find value even in simple, informal assessment of benefits and costs. Informal analysis may be enough to make the case for integration when there is competition of funds among various potential activities. Below are listed some categories of measures to consider at the outset of integration activities or when deciding how to capture the return on investment from collaboration.

Common Costs of Integration	Common Benefits of Integration
Start-up and meeting costs	Improved efficiency
Staff time reallocation (may not be increased)	Better products and services; reach and depth
Creation of shared/complementary systems	Cost-savings and access to resources
Training & Outreach (may be internal/no added cost)	Stronger relationships and more buy-in
Sometimes funds for shared activities/incentives	Flexibility, innovation and associated resiliency

Common Costs of Integration	Common Benefits of Integration
Start-up and meeting costs - Costs for planning activities - Costs for coordinating and hosting meetings between project partners	**Improved efficiency** - Operational efficiency - Shared task management - Optimization of division of labor - Speed in the development and/or implementation of solutions - Decreased bureaucracy, less siloed management - Decreased command and control approach (allowing for more informed goal setting)
Staff time reallocation (may not be increased) - Staff time allocated from existing activities to the new collaborative activity - Hiring of new staff to take on integration project tasks	**Better products and services, reach and depth** - Improved environmental, economic and organizational outcomes - Improved quality/effectiveness - Greater ability to address complex problems
Creation of shared/complementary systems - Costs associated with the administrative reorganization of activities, including potentially creating shared standard operating procedures - Costs to facilitate sharing data or shared information management systems	**Cost-savings and access to resources** - Leverage greater amounts and a wider variety of skills and resources than can be achieved by acting alone - Leveraging external resources to offset costs - Opportunities to achieve economies of scale - Access to/sharing of information - Access to other funds or in-kind supports - Leveraging of external resources - Making projects possible that would otherwise not be possible through pooling of funds and expertise - Decreased costs for planning and implementation
Training and Outreach - Outreach materials to explain new efforts - Cross-Training (may be internal, no additional cost)	**Stronger relationships and more buy-in** - Encourage broader participation in goal setting and problem solving - Facilitate building trust needed to work effectively - Stakeholder consultation across multiple areas - Development of networks to support shared work - Positive reputation and credibility - Build institutional structures for joint ownership - Buy-in on proposed solutions - Cooperation around technology
Contributing resources to shared activities - Cost of specific joint activities (events, processes, permitting, etc.) - Providing funds for incentives or grants - Joint reporting and/or evaluation	**Flexibility and innovation** - Flexibility/use of tailored solutions - Organizational innovation - Accommodation of broader perspectives, in ways that lead to more creative approaches to problem solving - Act as a catalyst for policy innovation

References for key work on value of collaboration and integration: Chrislip and Larson (1994); Kamensky and Burlin (2004); Klitgaard and Treverton (2003); Mattesich et al (2002); and Strauss (2002)

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