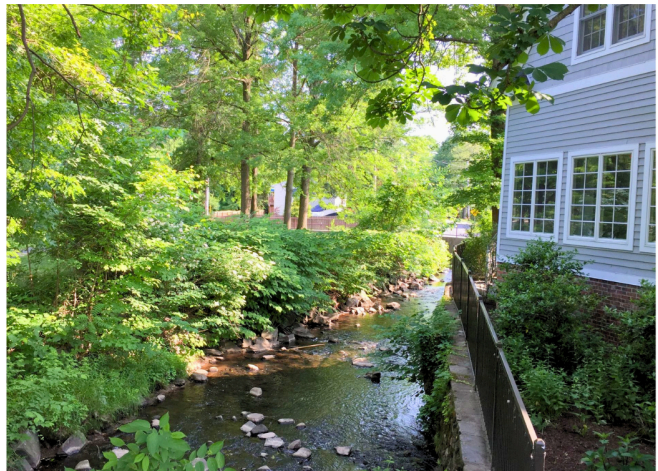


Watershed Characterization Guidance: Understanding and Sharing Your Watershed's Story



Hudson River
Watershed Alliance



October 2026

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Recommended citation:

Vail, Emily; Meierdiercks, Katherine; and Strong, Karen. 2026. *Watershed Characterization Guidance: Understanding and Sharing Your Watershed's Story*. Hudson River Watershed Alliance. <https://hudsonwatershed.org/watershed-characterization-guidance/>

Cover photos (clockwise from top left): Punch Brook-Roeliff Jansen Kill watershed, as seen from Drowned Lands Swamp Conservation Area (photo by Emily Vail); Sparkill Creek Watershed Characterization Community Presentation (photo by Emily Vail); Sparkill Creek at Tappan (photo by Larry Vail); Punch Brook-Roeliff Jansen Kill Watershed Characterization Community Presentation (photo by Emily Vail)



The Hudson River Watershed Alliance unites and empowers communities to protect our shared waters. We work across the Hudson River watershed to support watershed groups, help communities work together on water issues, and communicate as a collective voice.



Department of
Environmental
Conservation

Hudson River
Estuary Program

This Project has been funded in part by a grant from the New York State Environmental Protection Fund through the Hudson River Estuary Program of the New York State Department of Environmental Conservation. The opinions, results, findings, and/or interpretations of data contained therein are the responsibility of the Contractor and do not necessarily represent the opinions, interpretations or policy of the State.

The inspiration for this guidance document came from [*Creating a Natural Resources Inventory: A Guide for Communities in the Hudson River Estuary Watershed*](#) (2014), written by Ingrid Haeckel and Laura Heady from the Cornell University Department of Natural Resources and New York State Department of Environmental Conservation's Hudson River Estuary Program.

This guidance was directly informed by lessons learned from the Hudson River Watershed Alliance's watershed characterization pilot process from 2022-2024, supported by funding from the Hudson River Estuary Program, New York State Department of Environmental Conservation, with support from the New York State Environmental Protection Fund, in cooperation with NEIWPCC. Key partners in this process included the Roe Jan Watershed Community, the Town of Ancram, members of the Punch Brook-Roeliff Jansen Kill Watershed Characterization Advisory Committee, the Sparkill Creek Watershed Alliance, members of the Sparkill Creek Watershed

Characterization Advisory Committee, Green Goat Maps, Strong Outcomes, Katherine Meierdiercks, members of the Hudson River Watershed Alliance Board of Directors, the Hudson River Estuary Program, and NEIWPC. Each project partner provided critical advice and feedback to inform the pilot project, which is reflected in this guidance document. [Chapter 1: Introduction](#) of this guidance document includes introductory text from the pilot project watershed characterization reports. This guidance was also informed by lessons learned from the Fishkill Creek watershed characterization mapping project in 2024, with insights from project team members Sergei Krasikov and the Fishkill Creek Watershed Alliance, Asher Pacht, Katherine Meierdiercks, and Charlie Gaffney.

Thank you to the Bard College Center for Environmental Policy graduate students for writing [Appendix G: Overview of watershed management plans from three U.S. regions](#) as part of their “Politics of Solutions” course in spring 2025. Their research, report, and final presentation provided valuable insights on watershed planning frameworks and best practices from across the country.

Thank you to Beth Roessler, Stream Buffer Coordinator, New York State Department of Environmental Conservation Hudson River Estuary Program/New York State Water Resources Institute at Cornell University and Katherine Black, Irene Holak, and Brittany Ryan from New York State Department of State for their review and support of this guidance document.

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Executive Summary

A watershed characterization compiles and synthesizes existing information about a watershed into a cohesive narrative, which can guide community-led watershed planning, ground watershed management decisions, and build interest in and support for watershed work. A watershed characterization may be a standalone product, or it can be the starting, foundational “inventory” of a broader watershed planning project to build consensus and identify priority watershed management strategies.

The purpose of this watershed characterization guidance document is to share information and process considerations to support the development of locally-led watershed characterizations in the Hudson River watershed. This guidance builds on watershed planning frameworks used for watershed planning in New York State. Is not intended to be prescriptive. Rather, it includes resources and advice based on the Hudson River Watershed Alliance’s experience with watershed characterization and planning.

This document shares recommendations, guidance, and potential opportunities for groups to consider. It is intended to make more explicit many of the often “hidden” decisions that are required when working on a watershed characterization, providing manageable guidance and templates for watershed groups of different capacities. Many details for specific watershed characterizations will be informed by specific watershed motivations and goals, and are best determined through active decision-making from the project’s leadership and/or advisory committee. This guidance document is designed to help groups plan for and evaluate many of those decisions.

The guidance document is organized into the following chapters.

Chapter 1: Introduction provides an overview of watershed characterization, its role in the broader watershed planning and management process, and its multiple benefits. This chapter shares why watersheds are an appropriate scale for understanding and managing our shared waters, and provides background information on how this project began.

Chapter 2: Watershed Planning Frameworks provides an overview of the two primary frameworks used for locally-led watershed planning in New York State: United States Environmental Protection Agency (US EPA) / New York State Department of Environmental Conservation (NYS DEC) 9 Element watershed plans and New York State Department of State (NYS DOS) Watershed Management Plans. Because watershed characterization is a vital step in watershed planning, it is helpful to understand the different kinds of watershed planning frameworks in New York State, especially if a watershed group’s long-term goal is to undertake a complete watershed plan.

Chapter 3: Watershed Characterization Process: Getting Started shares resources and information to support the project scoping process, the initial steps that should be completed

before information and data compilation begins. Guidance on building the team (who), content focus (what), geography and scale (where), and motivations (why) are included. Investing energy into this phase of the watershed characterization process can help ensure that the watershed characterization process is successful and the outcomes are impactful.

Chapter 4: Watershed Characterization Process: What to Include describes the kinds of information that can be included in a watershed characterization, along with processes to find, organize, and evaluate that information.

Chapter 5: Watershed Characterization Products describes the different elements that can be included in a watershed characterization and ways to synthesize and communicate the watershed information and data.

Chapter 6: Using a Watershed Characterization for Next Steps shares opportunities and ideas for ways that the watershed characterization can be used after it is completed to support new and ongoing watershed work.

The Appendices provide templates, checklists, worksheets, and more specific guidance.

Appendices A, B, and C provide watershed characterization report templates, examples of watershed characterization maps and GIS layers, sources of GIS data, and checklists for both GIS data and other relevant information to include. **Appendix D** includes self-assessment worksheets to define specific next steps in a watershed characterization or planning process. **Appendix E** shares best practices for student/academic institution and community collaborations in support of watershed characterization, and **Appendix F** describes lessons learned from research on effective watershed planning from other regions across the United States.

While many may find it beneficial to read this guidance document in order, each chapter and appendix is designed to stand on its own and can be used in any order. Not all of the content may be relevant for all projects, and those chapters or sections may be skipped altogether. We encourage groups to navigate the sections in the order that best meets their goals. Whether looking for a specific template or tool, or exploring the full guidance, this document is organized to help watershed groups more quickly find advice and resources that can support effective local watershed management.

Chapter 1: Introduction

This watershed characterization guidance document is designed to support the development of watershed characterizations in the Hudson River watershed. This document builds on watershed planning guidance from the United States Environmental Protection Agency (US EPA), New York State Department of Environmental Conservation (NYS DEC), and the New York Department of State (NYS DOS). It provides additional support and characterization-specific technical guidance for watershed groups seeking to complete a watershed characterization as a standalone project or as part of a broader watershed planning process.

Specifically, this guidance is intended to make more explicit many of the often “hidden” decisions that are required when working on a watershed characterization, providing manageable guidance and templates for watershed groups of different capacities. The guidance in this document is evidence-based, based on the authors’ watershed characterization and planning experience. It especially draws from experience with three watershed characterization pilot projects in the Hudson River watershed: the Punch-Brook Roeliff Jansen Kill, Sparkill Creek, and Fishkill Creek watersheds, which include a range of land uses and watershed sizes.

This document shares recommendations, guidance, and potential opportunities for groups to consider, rather than a rigid formula for conducting a watershed characterization. Many details for specific watershed characterizations will be informed by specific watershed motivations and goals, and are best determined through active decision-making from the project’s leadership and/or Advisory Committee. This guidance document is designed to help groups plan for and evaluate many of those decisions.

This chapter defines watershed characterizations, their multiple benefits for locally-led watershed work, and their role in broader watershed planning and management processes. We start with why watersheds are an appropriate scale for understanding and managing our shared waters, as well as background information on how this project began. Chapter 2 provides additional information on the watershed planning frameworks used in New York State, while Chapters 3 through 6 provide actionable guidance for watershed groups before, during, and after the watershed characterization process. Materials in the appendices provide templates, checklists, worksheets, and more specific advice.

What is a watershed characterization?

A watershed characterization is a process and product that compiles and synthesizes existing information about a watershed into a cohesive narrative, which can build interest in and support for watershed work, ground watershed management decisions, and guide community-led watershed planning. The watershed characterization report brings together and organizes existing information about current watershed conditions into one place, describing and illustrating the physical characteristics, lands, waters, and people of a particular watershed.

The watershed characterization report tells the story of the watershed, including what is known and where there may be gaps in available information. It provides a foundation for identifying priority actions through watershed planning and can serve as a resource for partners to build local interest in the watershed and support for future watershed management. The watershed characterization process and product can help upstream and downstream communities to understand current conditions of their shared lands and waters.

The watershed characterization is a key part of a broader watershed planning process and framework. A watershed characterization can be a standalone product, or serve as a starting point for a full watershed plan that comes later. For more information on the role of characterizations in watershed planning processes and frameworks, see [Chapter 2: Watershed Planning Frameworks in New York State](#).

Watershed characterization products can take a variety of different forms (such as reports or websites), and their content can include a range of different topics or focus areas. For the purposes of this guidance document, we are referring to “watershed characterizations” as any project that compiles information from different sources, provides an understanding of current watershed conditions, and results in a product that can be cited. For more information on options for watershed characterization forms and focus areas, see the Chapter 3 subsections: [Watershed characterization products](#) and [Watershed characterization focus](#).

Why watersheds?

While other natural resource and environmental planning frameworks exist, watersheds are the geographic unit best suited for understanding conditions and managing our waters. Many conservation plans are based on political boundaries, including municipal, county, or state lines. However, because water usually does not follow political boundaries, using watersheds allows for a more holistic approach, considering problems and potential solutions up and downstream.

Watersheds are made up of all of the lands and waters that flow to a specific body of water. Precipitation, surface water, and groundwater within a watershed all flow to a common waterbody. Watersheds are broadly defined by topography and the lay of the land (Figure 1). However, water infrastructure and past development can change the way water flows across the landscape, which can complicate watershed boundaries at a more local scale. Regardless of whether they include natural or human-influenced flow patterns, a watershed defines the boundaries of a system of hydrologically connected people, places, and things; the activities at every point in a watershed impact all points downstream and are impacted by activities at all points upstream ([Meierdiercks et al. 2024](#)).

Watersheds can be large or small. The Hudson River watershed is about 13,400 square miles, extending from the Adirondack Mountains to New York City. Many smaller rivers and streams flow into the Hudson River along the way, and each of these tributaries has its own watershed that affects the health of the larger watershed ecosystem.

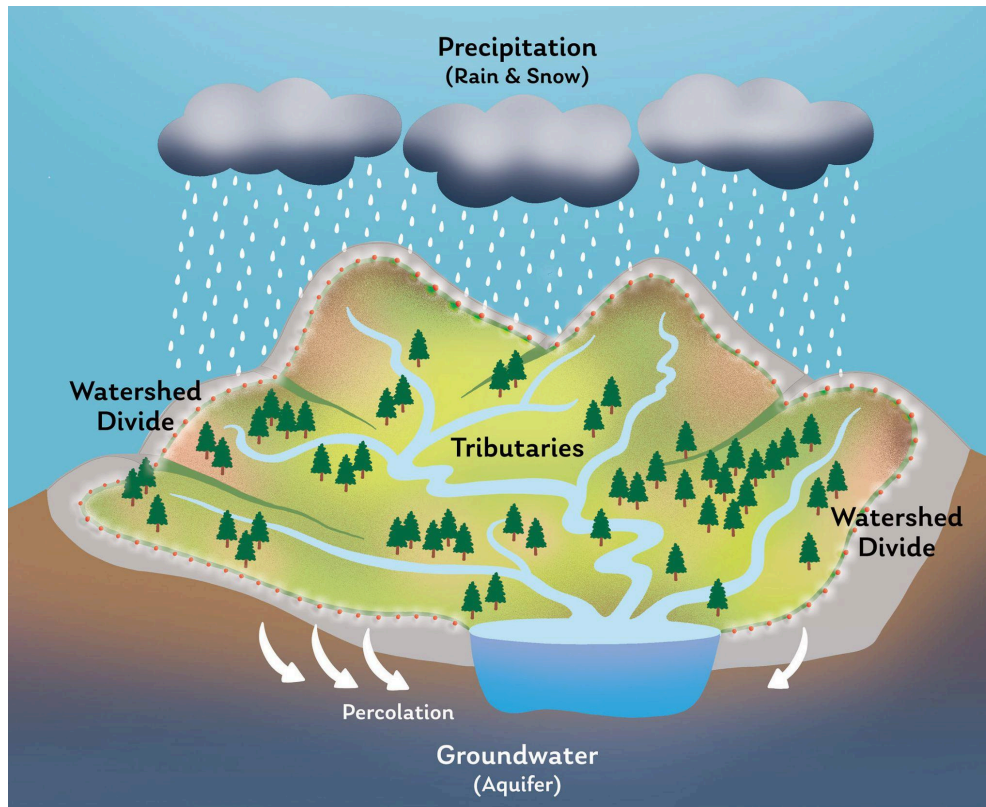


Figure 1. Depiction of a watershed, the lands and waters that flow to a specific body of water (Hudson River Watershed Alliance).

Working at the watershed scale is an opportunity to consider the intersections of environmental and social dynamics and their impacts on water quality, availability, and access. Collaborating across boundaries for collective benefit requires building partnerships across municipalities. It takes time to build new relationships. However, because solving water issues may rely on collaborating with neighboring communities, taking that time will be better for the waterbodies and the people who care about and depend on them. Plans developed at the watershed scale are more successful at addressing existing and preventing future water quality problems because they involve decision-makers in both upstream and downstream communities throughout the watershed ([US EPA 2008](#)).

The role of watershed characterization in watershed planning and management

Understanding the watershed through a watershed characterization is the first step in a watershed planning process. A watershed characterization compiles existing information together into one report, with maps, charts, and narrative to describe current watershed conditions. As watershed management can be complex and multidisciplinary, the watershed characterization report supports the understanding of local conditions by bringing together information from a wide range of sources to be used for decision-making and actions.

A watershed plan (also called a watershed management plan) is a non-regulatory document that identifies current or potential issues within a watershed, proposes solutions, and creates a strategy for putting those solutions into action. While many watershed plans have focused specifically on nonpoint or point sources of pollution, watershed plans may also include other issues considered at a watershed scale, such as flooding, climate resilience, terrestrial and aquatic habitats, water quality, recreation, environmental justice, and other priorities for the watershed communities.

A watershed plan builds on the scientific foundation of the watershed characterization report to identify those solutions and actions. The watershed planning process brings together a broad set of people from across the watershed to identify shared goals and a vision for the future. Using the present-day conditions documented within the watershed characterization as a starting point, and the goals and objectives for the watershed in the future, the planning process provides the opportunity for people to work together to prioritize specific, strategic actions to improve their watershed's health.

Watershed planning is often an iterative process. Watershed characterizations or plans may need to be updated or added to, especially when new information, partners, priorities, funding sources, implementation opportunities, or other resources become available. In the textbook *Integrated Watershed Management: Principles and Practice* (2009), Isobel Heathcote notes (emphasis added):

“[A] good watershed plan is not a single product, such as a document that sits on an agency bookshelf. **Instead, it is a framework for continued dialogue about water and the watershed.** Ideas endorsed by the planning team must be revised and reviewed periodically to determine whether they are still acceptable or could be improved. New technology and management thinking must be incorporated into the evolving plan. Most of all, the watershed management plan must reflect the current societal consensus about the value of water as a resource, about responsibilities and social attitudes, and about the community vision of an ideal watershed state. Integrated watershed management is, therefore, a journey, not a destination.”

Because watersheds are dynamic, watershed characterization and plans should also be dynamic. They can help a community understand evolving social and physical landscapes to better inform planning and management. For more information on how watershed characterizations fit into watershed planning frameworks, see [Chapter 2: Watershed Planning Frameworks in New York State](#).

Benefits of watershed characterization

In addition to being an important part of the initial phase of the watershed planning process, the watershed characterization process and product(s) provide many benefits and valuable outcomes, described below.

Compiling information

By compiling information from different sources together into one report, watershed characterizations provide a pathway to interpret, compare, and use information that might have otherwise sat unused on a shelf, in a hard drive, or within a database. Disparate information becomes easy to find, reference, and cite.

The characterization can provide a valuable process for organizing information, building a reference library of past studies, and maintaining institutional knowledge that could otherwise be lost. A centralized, usable record of watershed knowledge can help watershed groups understand what is known and what is not. Having information easily on hand and accessible within the watershed characterization report can make it easier for new watershed group members or partners to get up to speed, supporting faster onboarding and opening up more capacity.

Growing stronger relationships, support, and trust

The watershed characterization process can bring people together from across the watershed, which provides many benefits. This process can grow stronger relationships between watershed groups, municipalities, and partners, with opportunities to create new partnerships across boundaries for future watershed management and collaboration. For example, municipalities that have completed natural resources or conservation planning work at a municipal scale may not have worked with other municipalities upstream and downstream, and these new relationships may open new project collaboration opportunities.

The watershed characterization process often starts conversations to build stronger relationships and trust, so that if and when a watershed planning process begins, people are already engaged and at the table. Having these relationships in place prior to starting the planning process can improve planning outcomes by acknowledging past projects, not reinventing the wheel, understanding priorities of different groups and stakeholders, and valuing local knowledge ([Meierdiercks et al. 2025](#)).

As the broader community is engaged in the watershed characterization process, it also increases public awareness of the watershed. Community support is necessary for priority watershed management strategies to be successfully implemented after a plan is complete. Many people don't know the name of the watershed in which they live, or even that they live in a watershed at all ([McCarroll & Hamann 2020](#)). The watershed maps that are created as part of a watershed characterization in particular can be used to start conversations and connect people to their watersheds ([Meierdiercks et al. 2025](#)). They can also be used by communities as tools for storytelling, education, outreach, advocacy, and building legitimacy for lived experience ([Lively et al. 2026](#)).

Understanding watershed problems to develop solutions

Watershed characterizations are crucial for identifying and scoping watershed problems, in order to develop effective management solutions through the watershed planning process. It is important to understand known challenges and any information gaps before prioritizing those problems and identifying potential solutions. According to the US EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*: "Without an understanding of where pollutants are coming from, it's almost impossible to understand their impact on watershed resources and to target your control efforts effectively" ([US EPA 2008](#)).

[Meierdiercks et al. \(2025\)](#) note:

"We may assume we know the most pressing problems a watershed faces, but a closer look can reveal key information that may be missing, or not understood by the entity guiding the planning and management process. Watershed characterization supports open-minded inquiry and helps stakeholders discover and understand watershed challenges. If the watershed management process is too solutions-driven without taking the time to understand the watershed from multiple perspectives, watershed problems may be understood incorrectly or inadequately."

Because watershed problems can be so complex, jumping straight into management solutions without fully understanding conditions on the ground can also produce projects that are ineffective, unsustainable, and possibly even unintentionally harmful ([Meierdiercks et al 2025](#)). For example, projects to restore an eroding streambank at a particular site need to consider the entire stream system to make sure the source of the problem is actually being addressed by the proposed solution and not actually creating new problems at that site or elsewhere.

The watershed characterization process helps to prioritize work to make the most of often limited resources, including time and project funding. The US EPA's *Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters* states: "The characterization and analysis process helps to focus management efforts on the most pressing needs within the watershed" ([US EPA 2013](#)). A watershed characterization provides focus and direction for the rest of the watershed planning process, so that recommended implementation projects can efficiently and effectively address identified issues ([US EPA 2008](#)).

The watershed characterization process enables a shared understanding of local watershed conditions for decision-making and actions, integrating information from across different geographies, disciplines, timescales, and sources. Even without a complete watershed planning process, the watershed characterization process can support finding alignment for and implementing priorities from other existing local plans, practices, and projects.

Building momentum for watershed planning and implementation

There is value in undertaking a watershed characterization as a standalone project, or well before a larger watershed planning process. The characterization process provides groups with a place to start and a project that can be completed with a more modest budget and timeline than a full watershed plan. The US EPA's *Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters* acknowledges that: "Many groups have found that tackling smaller projects and tasks early in the planning process can help to engage stakeholders and demonstrate progress, creating a sense of momentum that leads to long-term success" ([US EPA 2013](#)). The guidance materials here strive to break down the planning process into smaller, more manageable pieces and identify specific roles for people with specific expertise, to further make the most of each team member's capacity.

This approach to undertaking a watershed characterization as a standalone project can also help save time, money, and resources in the long run. When groups receive grant funding to develop a complete watershed plan, they often spend a good portion of their valuable time, energy, and resources on watershed characterization before true planning (problem-solving and prioritization) even begins ([Vail 2022a, b](#)). By having a watershed characterization prepared ahead of time, groups can devote more resources during the planning process to the complex decision-making around developing a shared vision for their watershed, building consensus and buy-in, and prioritizing specific strategies for implementation.

A watershed characterization may also be needed to understand what kind of watershed-scale plan will be most effective. This may be especially the case if the motivation for the characterization is exploratory, to better understand current conditions before selecting a specific watershed planning framework. The watershed characterization process can help groups take a closer look at current issues and initial goals to determine what kind of planning process and scope might be the right fit for next steps.

About this guidance document

Purpose

The purpose of this watershed characterization guidance document is to share information and process considerations to support the development of locally-led watershed characterizations in the Hudson River watershed. This document provides guidance and is not intended to be prescriptive. It includes resources and advice based on the Hudson River Watershed Alliance's experience with watershed characterization and planning. This document also compiles many links to existing references and resources to help navigate this process, and adapts watershed planning guidance to specifically focus on watershed characterization.

The watershed characterization process includes many "hidden" decisions, which can make this work slower, more challenging, and more expensive than anticipated. These decisions are best

made by the local people leading and participating in this process. This document is designed to make implicit decisions more explicit, so that groups are better prepared and more intentional about what kind of process and product will best serve their specific watershed. These types of decisions can be undervalued and are often invisible to those outside of the project team, but are critical for ensuring that the watershed characterization is locally relevant and able to be used for next steps ([Meierdiercks et al. 2025](#)).

Using this guidance document can help groups understand the potential approaches for watershed characterization and planning ahead of getting started. By exploring different approaches ahead of time, groups can plan ahead to identify specific goals, and define a process and product that can best meet those goals. Active decision-making will lead to a more intentional process, with better outcomes.

This document was informed by two pilot watershed characterizations led by the Hudson River Watershed Alliance, which can serve as templates for future watershed characterizations. More detailed information is available in the Chapter 1 subsection [Pilot watershed characterization projects](#) and [Appendix A: Watershed Characterization Templates](#). A third watershed characterization mapping project provided key insights on opportunities for watershed group-academic partnerships. [Appendix B: Sample Watershed Characterization Maps and Layers](#) provides sample watershed characterization maps and layers for all three projects.

Our goal in providing these templates and example maps is to reduce workload burdens and “decision fatigue” at the beginning of the planning process, enabling more time and capacity to customize maps and other characterization materials to best achieve local goals. Rather than starting from scratch, elements of the templates can be replicated, so that more energy and time can be focused on decision-making conversations to adapt the templates to better address local needs and interests ([Meierdiercks et al. 2025](#)).

Intended audience

The guidance document is intended for watershed groups in the Hudson River watershed that are interested in learning about and undertaking watershed characterization or planning projects. It may also be valuable for municipal representatives, students and academic partners, local and regional nonprofits, and anyone interested in participating in or supporting a watershed characterization or planning process. While this guidance focuses on the Hudson River watershed, it is relevant throughout New York State, along with other states or other audiences who are leading or supporting locally-led watershed characterization and/or planning. The information and tools within this guidance document may also be valuable for other watershed-scale or conservation planning efforts, such as source water protection, flood resilience, stream management, and other types of inventories or plans.

How this guidance is organized

While many may find it beneficial to read this guidance document in order, each chapter and appendix is designed to stand on its own and can be used in any order. Not all of the content may be relevant for all projects, and those chapters or sections may be skipped altogether. We encourage groups to navigate the sections in the order that best meets their goals. Whether looking for a specific template or tool, or exploring the full guidance, this document is organized to help watershed groups more quickly find advice and resources that can support effective local watershed management.

Chapter 1: Introduction provides an overview of watershed characterization, its role in the broader watershed planning and management process, and its multiple benefits. This chapter shares why watersheds are an appropriate scale for understanding and managing our shared waters, and provides background information on how this project began.

Chapter 2: Watershed Planning Frameworks provides an overview of the two primary frameworks used for locally-led watershed planning in New York State: US EPA / NYS DEC 9 Element watershed plans and NYS DOS Watershed Management Plans. Because watershed characterization is a vital step in watershed planning, it is helpful to understand the different kinds of watershed planning frameworks in New York State, especially if a watershed group's long-term goal is to undertake a complete watershed plan.

Chapter 3: Watershed Characterization Process: Getting Started shares resources and information to support the project scoping process, the initial steps of the watershed characterization that should be completed before data compilation can begin. Guidance on building the team (who), content focus (what), geography and scale (where), and motivations (why) are included. Investing energy into this phase of the watershed characterization process can help ensure the watershed characterization process is successful and the outcomes are impactful.

Chapter 4: Watershed Characterization Process: What to Include describes the kinds of information that can be included in a watershed characterization, along with processes to find, organize, and evaluate that information.

Chapter 5: Watershed Characterization Products describes the different elements that can be included in a watershed characterization and ways to synthesize and communicate the watershed information and data.

Chapter 6: Using a Watershed Characterization for Next Steps shares opportunities and ideas for ways that the watershed characterization can be used after it is completed to support new and ongoing watershed work.

The Appendices provide templates, checklists, worksheets, and more specific guidance. **Appendices A, B, and C** provide watershed characterization report templates, examples of watershed characterization maps and GIS layers, sources of GIS data, and checklists for both GIS data and other relevant information to include. **Appendix D** includes self-assessment worksheets to define specific next steps in a watershed characterization or planning process. **Appendix E** shares best practices for student/academic institution and community collaborations in support of watershed characterization, and **Appendix F** describes lessons learned from research on effective watershed planning from other regions across the United States.

Alignment with New York State programs and plans

This watershed characterization guidance document helps to implement the [Hudson River Estuary Action Agenda](#), which provides a vision and plan to help people enjoy, protect, and revitalize the Hudson River estuary and its valley. The *Hudson River Estuary Action Agenda 2026–2030* includes goals for “A Thriving and Resilient Watershed,” including: “Healthy rivers and streams are maintained, while degraded tributaries are identified and improved to deliver high-quality fresh water to the estuary and to drinking water sources while providing for important habitat connections.”

The information in this guidance document complements the New York State Department of State and Department of Environmental Conservation’s 2009 [Guidebook on Watershed Plans: Protecting and Restoring Water Quality](#). It aligns with processes outlined in New York State’s watershed planning frameworks, including New York State Department of State watershed plans and 9 Element watershed plans, while providing additional support and characterization-specific technical guidance. (For more information, see [Chapter 2: Watershed Planning Frameworks in New York State](#).)

New York State’s [Climate Smart Communities](#) program for municipalities provides points towards Climate Smart Communities certification for both watershed characterizations and plans through the [Pledge Element 7 Action: Watershed Plan for Water Quality](#).

Project background

Understanding watershed group needs

The Hudson River Watershed Alliance’s mission is to unite and empower communities to protect our shared waters. In support of this mission, from 2019-2021, the Hudson River Watershed Alliance conducted an in-depth [Watershed Needs Assessment](#) to better understand the needs of watershed groups in the Hudson River watershed. Through semi-structured interviews and focus groups, we spoke with 56 Hudson River watershed group leaders and regional partners about watershed group challenges, barriers, needs, strengths, and accomplishments.

Within the Watershed Needs Assessment, watershed groups articulated the need for watershed plans to guide their work ([Vail 2022a, b](#)). They described the challenges of setting priorities for their group, when there are so many diverse and complex issues facing watersheds and competing for their attention ([Vail 2022a, b](#)). Effective planning helps increase watershed group capacity, a critical need for watershed groups to sustain their impact over time ([Finewood et al. 2024](#)). Types of plans that would support watershed work included strategic plans to guide organizational development, work plans to prioritize shorter-term projects, and watershed plans to identify strategic actions by a variety of stakeholders across the watershed scale ([Vail et al. 2024](#)).

While watershed groups play important roles and have achieved many accomplishments, almost every watershed problem is too complex for a small watershed group to solve alone ([Vail 2020](#), [Finewood et al. 2024](#), [Vail et al. 2024](#)). The watershed characterization and planning process brings together people from across municipal boundaries and sectors to document current watershed conditions; define future goals; prioritize specific, strategic, implementable actions to improve their watershed's health; and build the buy-in and support necessary for collaborative and effective watershed management.

Pilot watershed characterization projects

To help address watershed groups' need for additional support in watershed planning and challenges of limited capacity, the Hudson River Watershed Alliance undertook pilot watershed characterization projects in two small watersheds. From 2022-2024, the Hudson River Watershed Alliance worked with local Advisory Committees to create watershed characterizations for the [Punch Brook-Roeliff Jansen Kill watershed](#) and the [Sparkill Creek watershed](#). The process included organizing a watershed advisory committee, delineating the focus watershed, gathering existing data, and organizing and summarizing the information into a written report. Each watershed characterization report was designed to serve as a template for future reference. This pilot watershed characterization technical assistance was supported by funding from the Hudson River Estuary Program, New York State Department of Environmental Conservation, with support from the New York State Environmental Protection Fund, in cooperation with NEIWPCC.

Materials from the watershed characterization pilot project, including copies of each watershed characterization report, are available in [Appendix A: Watershed Characterization Templates](#). Appendix A also includes copies of maps, recordings of presentations, project fact sheets, and information about each watershed and the project team to help watershed groups consider which template might be most relevant for their watershed.

These projects provided direct experience with the watershed characterization process to support watershed work locally in these watersheds, and also informed recommendations and guidance to support the region as a whole. We intentionally selected pilot watersheds that were small enough to be manageable given the project's timeline, budget, and scope, while also

offering a level of complexity that would provide important insights for other watershed characterizations. (As the size of the focus watershed increases, so too does the number of jurisdictions, watershed groups, organizations, and, often, available information to include.) Both watersheds included six local municipalities, in addition to two different counties. The Sparkill Creek watershed also included information from a different state, New Jersey. Both watersheds also had active watershed groups, the Roe Jan Watershed Community and Sparkill Creek Watershed Alliance.

The pilot watershed characterization process included one watershed in a rural setting (Punch Brook-Roeliff Jansen Kill watershed) and one in a suburban/urban setting (Sparkill Creek watershed). This allowed us to better understand similarities and differences in available data and information across a wide range of land uses.

Following the initial pilot project, a third case study helped us to understand watershed characterization mapping in a larger watershed with more mixed land uses. In summer 2024, the Hudson River Watershed Alliance partnered with the Fishkill Creek Watershed Alliance, Clarkson University, and Siena University to develop [watershed characterization maps](#) for the Fishkill Creek watershed. (The Fishkill Creek watershed is 193 square miles, compared to the 47.5 square mile Punch Brook-Roeliff Jansen Kill watershed and the 11.2 square mile Sparkill Creek watershed.) The project team developed maps by focusing on accessible state, federal, and regional datasets, as this was designed to be the first phase of a larger watershed characterization project.

A key goal of the Fishkill Creek watershed characterization mapping project was to better understand opportunities for watershed groups to partner with academic institutions, especially for students to gain hands-on experience with watershed characterization mapping. The student partner on this project had completed a one-semester introductory GIS course and was hired to create the initial map series over the summer for course credit, with advising from a faculty mentor. The project was mutually beneficial, with the student partner gaining important academic and professional skills, while providing technical GIS services to the community-led Fishkill Creek Watershed Alliance. Lessons learned are shared in [Appendix F: Resources to Engage Students in Watershed Characterization Projects](#), which includes a [peer-reviewed journal article](#) and [Watershed Characterization Guidance Document for Students and their Mentors](#).

Our process for, experience of, and lessons learned from conducting these three projects are included in Chapters 3, 4, and 5 and Appendices A, B, C, and D of this guidance document, along with general guidance and best practices.

Watershed characterization & planning workshop

To share information and gather feedback as part of this project, the Hudson River Watershed Alliance held an interactive Watershed Characterization & Planning Workshop on March 24,

2026 at The Heartwood at Vassar College in Poughkeepsie, NY. The workshop focused on advancing locally-led watershed characterization, planning, and implementation. More information, recordings of presentations, copies of workshop materials, and self-assessment worksheets to guide next steps are available in [Appendix E: Worksheets to Identify Watershed Characterization/Planning Next Steps](#) and on the [Hudson River Watershed Alliance's website](#). This guidance document benefited from the questions raised and insights shared by workshop participants.

Key Points

Key points from Chapter 1: Introduction include:

- Watershed characterization is both a process (compiling/synthesizing data, community building) and a product (citable report) that documents current watershed conditions. It tells the story of the watershed through data, maps, and narrative about the watershed's lands, water, people, and other characteristics.
- Although other natural resource and conservation planning frameworks exist, a watershed is the scale best suited for understanding and managing shared waters. Effective water management requires collaboration across municipal, county, and even state boundaries, as waters are rarely confined within a single geopolitical boundary.
- While often the first phase of a broader watershed planning process, watershed characterization can also serve as a standalone project or a place to get started. Watershed characterization can provide a range of benefits, including ensuring that institutional knowledge is not lost when group members change, easier onboarding of new watershed group members, fostering trust and relationship building between watershed group members and partners, promoting effective solutions by ensuring problems are better understood, and building momentum and support for watershed planning across and within municipalities.
- This guidance document is meant to build on existing watershed management frameworks and provide additional guidance for community-led watershed planning. It makes explicit the often “hidden” decisions that are part of the watershed characterization process for active local decision-making. The guidance is evidence-based, drawing from experience with projects in the Punch-Brook Roeliff Jansen Kill, Sparkill Creek, and Fishkill Creek watersheds. It is designed to help meet the watershed planning needs of watershed groups located in the Hudson River watershed.

Chapter 2: Watershed Planning Frameworks in New York State

Introduction

Watershed characterization is a vital step in watershed planning. Especially if a watershed group's long-term goal is to undertake a complete watershed plan, having an understanding of the options available for watershed planning in New York State can help create a watershed characterization process and product that will best support their needs.

This chapter provides an overview of the two frameworks used most often for locally-led watershed planning in New York State:

- 9 Element (9E) watershed plans and
- New York State Department of State (DOS) watershed management plans.

Within each of these frameworks, watershed characterization serves as the foundational or “inventory” phase of the broader planning effort.

This chapter provides an overview of the two different watershed planning frameworks, with links to specific resources for more detailed information that might be helpful for watershed groups that are undertaking a watershed characterization process. US EPA, NYS DEC, and NYS DOS each provide watershed characterization guidance in their respective watershed planning guides and other resources. This Hudson River Watershed Alliance watershed characterization guidance document does not replace that information, but rather complements it. This chapter shares planning options and workplans, so it is easier to broadly compare the different approaches to find the right fit.

The right planning framework for a local watershed depends on the particular set of watershed challenges and goals. One is not better than the other. The guidance available provides valuable advice and resources that may also be useful for groups to adapt to their own processes and products, including both watershed characterizations and plans. This chapter is intended to provide an overview of the full watershed planning process in New York State using these two frameworks, how a watershed characterization fits in, and how a broader watershed planning process can be broken down into smaller steps.

Note that the resources described and linked are based on materials available at the time of publication, and are general watershed planning process steps. For the most up-to-date details and workplans, please refer to watershed planning materials available on the US EPA, NYS DEC, and NYS DOS websites.

What is a watershed plan?

A watershed plan outlines actionable steps that can be implemented within a watershed to address identified challenges. It is both a strategy and a work plan for achieving watershed goals

and making positive changes ([Napa County Watershed Information & Conservation Council 2026](#)). Watershed plans consider actions across the watershed geography that may be taken by a range of different organizations and entities, such as watershed groups, local governments, policymakers, soil and water conservation districts, community organizations, land trusts, local and regional nonprofits, academic institutions, and others. The primary purpose of a watershed plan is to guide these partners in strategic actions that work towards the collective vision for the watershed, serving as a long-term, comprehensive road map ([Tip of the Mitt Watershed Council 2026](#), [Iowa Department of Natural Resources 2026](#)).

Plans of all kinds use a similar framework: start by understanding current conditions, set goals for future conditions, and identify strategic actions to get from the present to the future.



Figure 2. Planning process steps, simplified.

A watershed plan is a specific type of plan that uses a watershed scale and approach to understand and improve the lands and waters within a specific, delineated watershed boundary. Watershed plans include a compilation of existing information (the watershed characterization), a vision and goals for the watershed, and specific actions to meet those goals.

Many watershed plans have focused on water quality, especially nonpoint source pollution. This process and product can be useful for improving “impaired” waterbodies with known water quality or other challenges, protecting healthy watersheds, and better understanding watersheds that include opportunities for both protection and restoration. They can also include a wide range of other focus areas to meet local needs. This can include aquatic or terrestrial habitat, climate resilience, flooding, environmental justice, and more.

Watershed planning is designed to be locally-led, in that people at the local level develop a specific vision and goals for their own watershed communities. Water quality and other watershed challenges rely on a wide array of partners to both understand problems and also to implement solutions. Having a diverse set of people with different experience and expertise at the table from the beginning will help with better plans and better planning outcomes.

For more information on watershed planning frameworks, case studies, and best practices from across the United States, see [Appendix G: Overview of watershed management plans from three U.S. regions](#).

Watershed planning in New York State

In New York State, there are two primary frameworks that are used for developing locally-led watershed plans:

- The US Environmental Protection Agency (US EPA)'s 9 Element watershed planning framework is described in the [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#) (2008). The 9 Element (9E) watershed planning framework was adapted by the New York State Department of Environmental Conservation (NYS DEC) for use in New York State as part of their Clean Water Plan framework.
- The New York State Department of State (NYS DOS)'s watershed planning framework is described in the NYS DOS and NYS DEC [Guidebook on Watershed Plans](#) (2009).

While the frameworks share the same general approach to the planning process, there are several differences. 9 Element watershed plans require the modeling of a specific water quality pollutant, including quantifying pollutant loading and estimating pollutant reductions. Because of this step, 9 Element watershed plans can be more expensive than NYS DOS plans. The 9 Element watershed plan framework is often well-suited for waterbodies with water quality issues caused by one or more known pollutants, such as phosphorus. NYS DOS plans tend to be broader, and can focus on a range of different water quality or other watershed-scale issues. NYS DOS watershed plans emphasize the role of local governments, especially local policy and intermunicipal coordination opportunities to protect watersheds.

The primary funding source for both types of watershed plans in New York State is through the NYS DOS [Local Waterfront Revitalization Program](#) (LWRP). NYS DOS has developed workplans for both DOS watershed plans and 9 Element watershed Plans that are funded through their grant program (Table 1). NYS DOS approves all watershed plans that are funded through their grants, with 9 Element watershed plans receiving additional review and approval by NYS DEC. 9 Element watershed plans funded by NYS DOS are required to also include a holistic review of information in addition to the modeling and reduction of a specific identified pollutant. Watershed plans can also be funded through other grant programs or funding mechanisms.

9 Element Watershed Plans

Guidance from the US Environmental Protection Agency

In 2008, the US EPA published the [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#). The complete PDF handbook, along with PDFs of individual chapters, is available to view and download on the [US EPA's website](#). The 400-page handbook provides comprehensive advice and steps to develop and implement 9 Element watershed management plans that help to restore and protect water quality.

The 2008 *Handbook* has been supplemented with other resources over time. In 2013, the US EPA published [A Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters](#),

which provides a more streamlined summary of the content of the 2008 *Handbook* and some updated topics. The US EPA also developed an [Introduction to Watershed Planning training module](#) to break down the steps of the process laid out in the 2008 *Handbook* and 2013 *Quick Guide*. The US EPA's [Healthy Watersheds Protection Program: Protecting Aquatic Systems via Landscape Approaches](#) provides resources and tools for understanding and assessing healthy watersheds to maintain high-quality water and aquatic ecosystems.

The [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#) (US EPA 2008) shares six steps for watershed planning:

1. Build partnerships.
2. Characterize the watershed.
3. Set goals and identify solutions.
4. Design an implementation program.
5. Implement the watershed plan.
6. Measure progress and make adjustments.

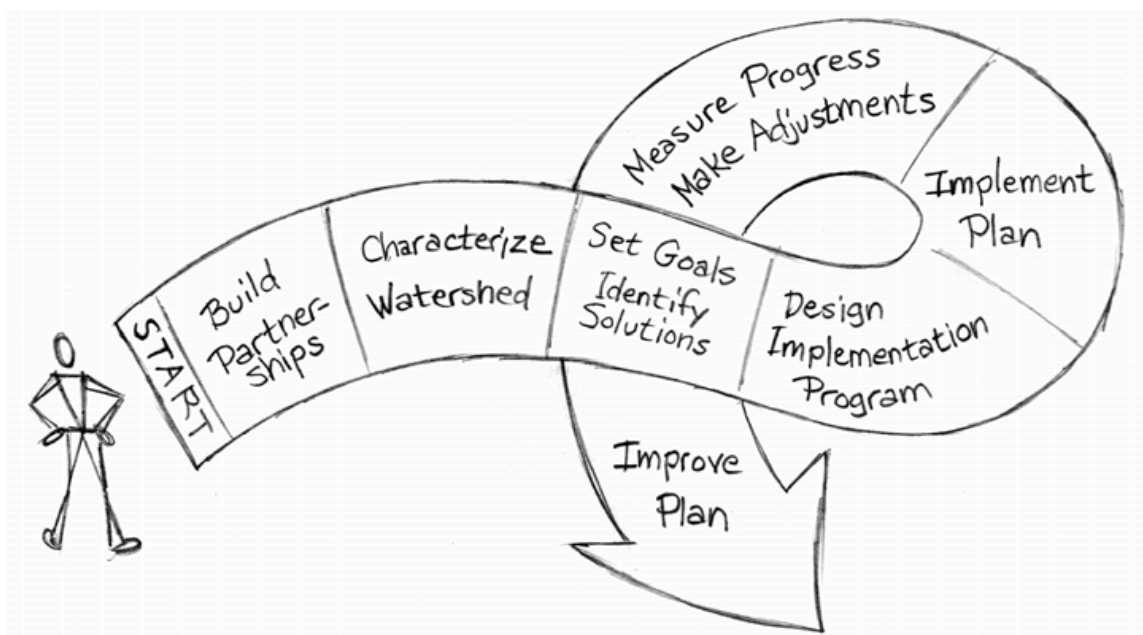


Figure 3. The watershed planning process. Image from US EPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters" (2008).

Within the 2008 *Handbook*, [Chapter 2: Overview of Watershed Planning](#) states:

"The watershed planning process works... by using a series of cooperative, iterative steps to characterize existing conditions, identify and prioritize problems, define management objectives, develop protection or remediation strategies, and implement and adapt selected actions as necessary. The outcomes of this process are documented or referenced in a watershed plan. A *watershed plan* is a strategy that provides assessment and management information for a geographically defined watershed,

including the analyses, actions, participants, and resources related to developing and implementing the plan. The development of watershed plans requires a certain level of technical expertise and the participation of a variety of people with diverse skills and knowledge.”

This framework also requires plans to include “9 key elements” or “9 minimum elements,” which has led to this framework’s name of “9 Element watershed plans.” The 2013 *Quick Guide* summarizes the nine minimum elements as:

- a. Identify causes and sources of pollution
- b. Estimate pollutant loading into the watershed and the expected load reductions
- c. Describe management measures that will achieve load reductions and targeted critical areas
- d. Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan
- e. Develop an information/education component
- f. Develop a project schedule
- g. Describe the interim, measurable milestones
- h. Identify indicators to measure progress
- i. Develop a monitoring component

These elements are not listed sequentially, and a helpful crosswalk of how the elements relate to each step of the watershed planning process is available on [page 12 of the 2013 Quick Guide](#) (US EPA 2013).

The 9 Element planning framework is specifically designed to align with the federal-scale regulations within the [Clean Water Act](#). Each element is labeled with a letter (a through i), rather than a number, to align with how they are presented in section 319 of the Clean Water Act ([US EPA 2013](#)). The 2008 *Handbook* emphasizes that 9 Element watershed plans should focus on how water quality standards can be met within the defined watershed, including Designated Uses, Water Quality Criteria, and Antidegradation Policies and Implementation Methods (US EPA 2008). While “the primary focus of this handbook is on waters listed as impaired under section 303(d) of the Clean Water Act, watershed plans are intended both to provide an analytic framework to restore water quality in impaired waters and to protect water quality in other waters adversely affected or threatened by point source and nonpoint source pollution” (US EPA 2008).

The 2008 *Handbook* also acknowledges that even if watershed plans do not contain all nine elements, this process can still inform a valuable approach. “If the existing plans do not address the nine elements, they can still provide a valuable framework for producing updated plans... In this case, the plan could be amended by adding this information and other key elements not contained in the original plan... EPA supports this overall approach—building on prior efforts and incorporating related information—as an efficient, effective response to the need for comprehensive watershed plans that address impaired and threatened waters” (US EPA 2008).

This framework has been adopted by many states, including New York State. More information on how NYS DEC works with 9 Element watershed plans is in the subsection below. For more information on how the NYS Department of State has broken down the 9 Element watershed planning process for their grant program, see Table 1 in the subsection on [New York State Department of State Watershed Management Plans](#).

For examples of 9 Element watershed plans from other states, see the research report by Bard College Center for Environmental Policy graduate students in [Appendix G: Overview of watershed management plans from three U.S. regions](#).

Watershed characterization guidance from US EPA

In the [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#) (US EPA 2008), [Chapter 5: Gather Existing Data and Create an Inventory](#) is particularly focused on the watershed characterization process. It recommends five broad categories and types of information to generally be used to characterize the watershed:

- Physical and natural features - watershed boundaries, hydrology, topography, soils, climate, habitat, wildlife.
- Land use and population characteristics - land use and land cover, existing management practices, demographics.
- Waterbody and watershed conditions - water quality standards, 305(b) report, 303(d) list, TMDL reports, source water assessments.
- Pollutant sources - point sources, nonpoint sources.
- Water body monitoring data - water quality and flow, biology, geomorphology.

The next three chapters of the 2008 *Handbook* also focus on aspects of the characterization process, as defined by US EPA:

- [Chapter 6: Identify Data Gaps and Collect Additional Data If Needed](#)
- [Chapter 7: Analyze Data to Characterize the Watershed and Pollutant Sources](#)
- [Chapter 8: Estimate Pollutant Loads](#)

Each of these could be included within a watershed characterization process, or they might be considered as separate projects, as budgets, timelines, and project scopes allow. Estimating pollutant loads is one of the unique elements required for a 9 Element watershed plan.

These chapters and steps are illustrated in Figure 4. The data inventory of the watershed characterization provides the foundation for the subsequent steps, and supports the development of management measures.

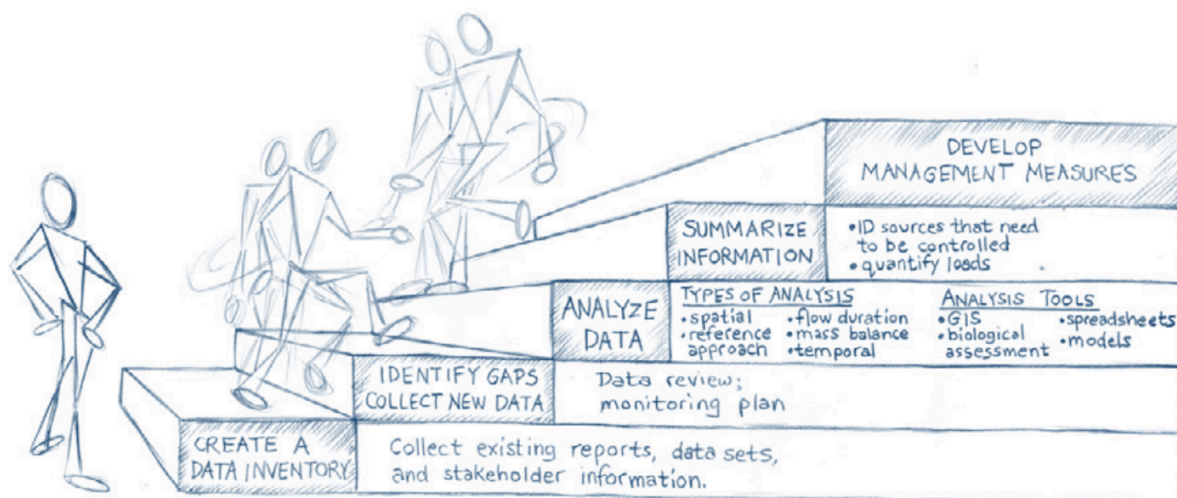


Figure 4. Illustration of watershed characterization steps. Image from US EPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters" (2008).

Guidance from the New York State Department of Environmental Conservation

NYS DEC adopted the US EPA's 9 Element watershed planning framework for use in New York State. It is the same framework; guidance from NYS DEC specifies what information needs to be included for the 9 Element watershed plan to be approved by NYS DEC.

9 Element watershed plans fit within NYS DEC's broader Clean Water Plan approach for restoring and protecting waterbodies. NYS DEC defines this approach on the [Clean Water Plans webpage](#): "Clean water plans are a watershed-based approach to outline a strategy to improve or protect water quality in a waterbody. These plans document pollution sources, set pollutant reduction goals, and identify strategies that communities may use to improve water quality. Types of Clean Water Plans include Total Maximum Daily Load (TMDL), Alternative Restoration Plan (ARP) and Nine Element Plan (9E)¹. EPA has set specific criteria that must be met for these three types of watershed-based plans."

9 Element watershed plans are developed by local watershed communities and are approved by NYS DEC. If the 9 Element watershed plan is funded by a NYS DOS LWRP grant, it is also approved by NYS DOS. 9 Element watershed plans that are funded by sources other than NYS DOS LWRP grants are only approved by NYS DEC. 9 Element watershed plans are non-regulatory.

¹ The other types of Clean Water Plans, Total Maximum Daily Loads (TMDLs) and Alternative Restoration Plans (ARPs), are developed by NYS DEC staff and are not locally-led. A Total Maximum Daily Load (TMDL) is a regulatory, watershed-scale plan developed by NYS DEC for waterbodies that are listed on the Clean Water Act 303(d) "impaired waters" list. Alternative Restoration Plans (ARPs) are also developed by NYS DEC, and provide an alternative restoration approach before developing a TMDL. Nine Element (9E) watershed plans have similar goals to TMDLs and ARPs, but they are unique in that they are locally-led.

NYS DEC's [Vision Approach to Implement Clean Water Act 303\(d\) Program and Clean Water Planning](#) (2015) provides an overview of NYS DEC's strategy to implement programs in support of section 303(d) of the Clean Water Act, including prioritizing waterbodies for 9 Element watershed plans. More information on assessing waterbodies and implementing Section 303(d) of the Clean Water Act is available on the [NYS DEC's Assessing Water Quality in NY website](#).

The [NYS DEC Clean Water Plans website](#) includes several other resources for developing 9 Element watershed plans, including:

- [Nine Element Watershed Plans: An Introduction](#) fact sheet,
- [Reviewer Guidance, Reviewer Checklist and Recommended 9E Plan Outline](#) (2019), which is used by Division of Water staff to review and approve 9 Element plans,
- [Presentation from Water Quality Symposium/ NYS CDEA Annual Training Session](#) (2016) that provides an overview of the nine elements and modeling,
- [Quality assurance project plan \(QAPP\) templates](#) for water quality monitoring and modeling, and
- PDF copies of [approved 9 Element watershed plans](#) in New York State.

The NYS DEC Division of Water uses a [watershed management approach](#) to guide its programs. Watershed planning and management is a key step in the NYS DEC Division of Water's ongoing "water wheel" of steps, which includes:

- [Monitoring](#) - gathering information on the health of New York State's waterbodies,
- [Assessment](#) - the process Division of Water undertakes to interpret monitoring results and report out on the health of waterbodies and their ability to meet their best uses,
- [Planning and Management](#) - the step to develop Clean Water Plans/watershed plans,
- Implementation and Permitting, and
- Compliance and Enforcement.

NYS DEC works with NYS DOS to support local watershed planning efforts. Both agencies recognize the importance of watershed planning as a means to protect and restore water resources and local economies and both administer grant programs to support local watershed planning efforts. For more information, visit the NYS DEC [Clean Water Act Section 604\(b\) Water Quality Planning Grants](#) webpage and the NYS Department of State [Water Resources Management](#) webpage.

Watershed characterization guidance from NYS DEC

The 2019 [Reviewer Guidance, Reviewer Checklist and Recommended 9E Plan Outline](#) by NYS DEC Division of Water describes the expectations for the watershed characterization within an approved 9 Element watershed plan. Pages 12-13 is the reviewer checklist, which NYS DEC Division of Water staff use to review and approve a 9 Element watershed plan, based on the criteria within US EPA's 2008 *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*.

The watershed characterization is part of Element A. Identify and quantify sources of pollution in the watershed. The 2019 *Reviewer Guidance* states that: “The plan should describe the watershed, including: soils, hydrology, land use, demographics and recreations; the water quality within the watershed, including: water quality monitoring, biological surveys, priority waterbody listings (303d), existing watershed plans, sources of the impairments and the causes. This information should be used to identify and quantify the sources of pollution.”

On pages 3-4, the 2019 *Reviewer Guidance* also includes a list of point and nonpoint sources of pollution that should be included within the watershed pollutant analysis, if present in the watershed, at a minimum, for a NYS DEC-approved 9 Element watershed plan. Those include land use characteristics, septic system loads, and point sources like wastewater treatment plants and other permitted facilities.

Any water quality sampling used to develop the watershed characterization within a 9 Element watershed plan must adhere to an approved Quality Assurance Project Plan (QAPP) and utilize a New York State Department of Health (NYS DOH) [Environmental Laboratory Approval Program](#) (ELAP) certified laboratory for analytical chemistry processing. More information, templates, and sample QAPPs are available on the NYS DEC’s [Quality Assurance and Quality Control of Water Quality Data](#) website.

Guidance from the New York State Department of State

NYS DOS can fund and approve both DOS watershed management plans and 9 Element watershed management plans, with specific work plans available for each framework. (See Table 1 for an example of each work plan.) NYS DOS-funded 9 Element watershed plans are also approved by NYS DEC. More information from NYS DOS on 9 Element watershed plans is available on their [9 Element Watershed Plans webpage](#). Watershed groups that are interested in pursuing NYS DOS LWRP grant funding for watershed planning are encouraged to discuss what the appropriate watershed planning framework might be with both NYS DOS and NYS DEC staff.

New York State Department of State Watershed Management Plans

In 2009, NYS DOS and NYS DEC published the [Guidebook on Watershed Plans: Protecting and Restoring Water Quality](#). Details and links to more information are available on the [NYS DOS Water Resources Management website](#), including a 2020 [Overview: Watershed Planning](#) fact sheet. NYS DOS lists five [major components of a watershed planning process](#), which are very similar to the six steps of watershed planning from US EPA:

1. Characterization
2. Watershed Management Recommendations
3. Implementation Strategy
4. Monitoring and Tracking
5. Community Outreach and Participation Plan

NYS DOS watershed plans emphasize the role of local governments, especially local policy and intermunicipal coordination opportunities to protect watersheds. According to their [2025-2026 Request For Applications for the Local Waterfront Revitalization Program](#):

“A watershed management plan is a type of LWRP Component that produces a comprehensive plan to protect and restore specific waterbodies and their watersheds by identifying and prioritizing land uses and capital projects to reduce point and nonpoint source pollution, and protect or restore water quality, tributary corridors and aquatic habitats. As watersheds generally encompass more than one municipal jurisdiction, the preparation of cooperative, intermunicipal plans for a specific watershed can be an effective way to achieve local, regional and statewide goals... The watershed management planning process is comprehensive, action oriented, and emphasizes broad environmental goals and objectives that cover all aspects of water quality.”

NYS DOS administers grant funding for watershed plans under Title 11 of the [New York State Environmental Protection Fund](#) (NYS EFP) [Local Waterfront Revitalization Program](#) (LWRP). Watershed plans are considered a non-regulatory “component” of an LWRP. Eligible applicants for NYS DOS LWRP grants are municipalities along a coastal waterbody or designated inland waterbody, regional planning boards, and counties applying on behalf of a town, village, or city that is located along a coastal waterbody or designated inland waterbody. Coastal waterbodies and designated inland waterbodies are defined in [NYS Executive Law, Article 42, Section 911: Waterfront Revitalization of Coastal Areas and Inland Waterways](#).

A list of approved and completed NYS DOS-funded watershed plans is available through their [Library](#). NYS DOS has also developed a map layer of [Watersheds with a Watershed Management \(WMP\) or Nine Element \(9E\) Plans, 2010-Present](#), available to view or download through the NYS DOS Geographic Information Gateway.

Watershed characterization guidance from NYS DOS

The NYS DOS’s [Major Components of a Watershed Plan website](#) broadly describes the watershed characterization component of a watershed plan as “an inventory and analysis that describes the current state of the watershed. It delineates the watershed and subwatershed boundaries and describes its waterbodies. It will describe the physical and biological characteristics of the watershed; including how the watershed functions; existing land use and land cover patterns; causes and sources of pollution; estimated pollutant loads; and trends within the watershed.”

Watershed characterizations within DOS-funded watershed plans (both watershed management plans and 9 Element watershed plans) include two parts:

- A. Description and Assessment of the Waterbody(ies) and Watershed Resources
- B. Description and Assessment of the Ability of Local Laws and Programs to Implement Best Management Practices to Protect Water Quality

Part B, Description and Assessment of the Ability of Local Laws and Programs to Implement Best Management Practices to Protect Water Quality, is “intended to result in the identification of strengths and gaps in a municipality’s ability to effectively manage pollution, as related to local regulations, routine operation and maintenance practices, training and outreach programs” (NYS DOS 2024). NYS DOS recommends following the methods in [Protecting Water Resources through Local Controls and Practices: An Assessment Manual for New York Municipalities](#) (2006), Section 2, Nonpoint Assessment and Gap Analysis, written by the Genesee/Finger Lakes Regional Planning Council, or a similar tool.

This step to assess local laws can be done as part of a watershed characterization, as required by the DOS grant work plan, but is often done on its own and incorporated into the watershed plan as its own chapter or appendix. This local law assessment can also be done as a standalone project to support the watershed planning process in more discrete steps. (The local law assessment component of a watershed characterization was not part of the Hudson River Watershed Alliance’s pilot watershed characterization project.)

Recipients of NYS DOS LWRP grants for watershed planning are required to follow one of two work plans to complete the watershed plan:

- [Watershed Management Plan – Work Plan](#) (NYS DOS 2026)
- [Nine Element Watershed Management Plan - Work Plan](#) (NYS DOS 2026)

Table 1 breaks down the steps listed in each of the work plans, with the watershed characterization step bolded in each. Tasks 1-6 are identical, and the watershed characterization process is the same for both types of watershed plans. Table 2 provides details on the watershed characterization task within each workplan. Some customization of NYS DOS work plans is allowable to include additional tasks and funding for watershed-specific needs, but the work plan tasks highlight the required pieces for an approved plan.

The main difference between the two work plans is that 9 Element watershed plans include modeling of pollutant reduction and a Quality Assurance Project Plan. For more information on Quality Assurance Project Plan requirements of 9 Element plans, see Chapter 2 subsection [Watershed characterization guidance from NYS DEC](#). NYS DOS encourages the inclusion of local knowledge in watershed characterizations, where appropriate. Water quality information included within a NYS DOS watershed plan’s watershed characterization is not required to have been processed in a NYS DOH Environmental Laboratory Approval Program (ELAP)-certified lab, and water quality sampling is not required to adhere to an approved Quality Assurance Project Plan (QAPP). This is required for a 9 Element watershed plan, including those that are funded by NYS DOS LWRP grants.

The work plans and watershed characterization task details in Tables 1 and 2 are based on materials available at the time of publication, and are generally watershed planning process steps. For the most up-to-date details and work plans, please refer to materials available on the [NYS Department of State website](#).

Table 1. DOS watershed plan work plans. Summarized from task headings in [Watershed Management Plan – Work Plan](#) (NYS DOS 2026) and [Nine Element Watershed Management Plan - Work Plan](#) (NYS DOS 2026).

Watershed Management Plan – Work Plan	9 Element Watershed Management Plan - Work Plan
Task 1: Project Initiation Meeting Task 2: Watershed Advisory Committee Task 3: Procurement of Consultant (if applicable) Task 4: Subcontract and Compliance with Local Procurement Requirements Task 5: Preparation of Community Outreach / Participation Plan Task 6: Watershed Advisory Committee Meetings Task 7: Initial Vision and Watershed Goals Task 8: Watershed Characterization Task 8.1 Description and Assessment of the Waterbody(ies) and Watershed Resources Task 8.2: Description and Assessment of the Ability of Local Laws and Programs to Implement Best Management Practices to Protect Water Quality Task 9: First public participation/outreach meeting Task 10: Refinement of Vision and Watershed Goals Task 11: Watershed Management Recommendations to Achieve Goals and Objectives A. Identify and Describe Management Strategies and Recommendations B. Prioritize Recommended Projects and Actions and Key to Map(s) Task 12: Second Public Participation/Outreach Meeting Task 13: Implementation Strategy and Schedule Task 14: Tracking and Monitoring Task 15: Draft Watershed Management Plan Task 16: Third Public Participation/Outreach Meeting Task 17: Final Watershed Management Plan Task 18: Final Project Summary Report & Measurable Results Task 19: MWBE Reporting Task 20: Project Status Reports	Task 1: Project Initiation Meeting Task 2: Watershed Advisory Committee Task 3: Procurement of Consultant (if applicable) Task 4: Subcontract and Compliance with Local Procurement Requirements Task 5: Preparation of Community Outreach / Participation Plan Task 6: Watershed Advisory Committee Meetings Task 7: Quality Assurance Project Plan Task 8: Initial Vision and Watershed Goals Task 9: Data Collection and Review Task 10: Model selection, setup, calibration, and testing Task 11: Watershed Characterization A. Description and Assessment of the Waterbody(ies) and Watershed Resources B. Description and Assessment of the Ability of Local Laws and Programs to Implement Best Management Practices to Protect Water Quality Task 12: First public participation/outreach meeting Task 13: Refinement of Vision and Watershed Goals Task 14: Evaluation of Scenarios Using Modeling Task 15: Nutrient/Pollutant Reduction Targets Task 16: Watershed Management Recommendations to Achieve Goals and Objectives A. Identify and Describe Management Strategies and Recommendations B. Prioritize Recommended Projects and Actions and Key to Map(s) Task 17: Second Public Participation/Outreach Meeting Task 18: Implementation Strategy and Schedule Task 19: Tracking and Monitoring Task 20: Draft 9 Element Watershed Management Plan Task 21: Third Public Participation/Outreach Meeting Task 22: Final 9 Element Watershed Management Plan Task 23: Final Project Summary Report & Measurable Results Task 24: MWBE Reporting Task 25: Project Status Reports

Table 2. NYS DOS-funded watershed characterization task details. All information taken directly from [Watershed Management Plan – Work Plan](#) (NYS DOS 2026) and [Nine Element Watershed Management Plan - Work Plan](#) (NYS DOS 2026).

Watershed Management Plan – Work Plan: Task 8: Watershed Characterization Task 8.1: Description and Assessment of the Waterbody(ies) and Watershed Resources Nine Element Watershed Management Plan - Work Plan: Task 11: Watershed Characterization A. Description and Assessment of the Waterbody(ies) and Watershed Resources
Based on the inventory, prepare a description and assessment that: ● Delineates the watershed and its constituent subwatersheds determined by an analysis of topography, existing drainage infrastructure, surface hydrology, field observation, and other factors as appropriate. ● Identifies and describes the geographic setting and features of the watershed, including topography, geology, hydrography, climate, floodplains, soils, areas of erosion, and precipitation. ● Identifies, describes and maps infrastructure (e.g., roads and bridges; stormwater infrastructure including outfalls; dams, and other impoundments or flow constriction structures). ● Describes current water quality conditions including trophic status, waterbody inventory/priority waterbodies list status. Waterbody impairments, sources of pollutant(s) of concern, ○ Identifies point sources and hot spots (i.e., NPDES Phase I & II permittees, septic and underground storage tanks, landfills and superfund sites). ○ Nonpoint sources as identified in monitoring and modeling ● Describes water quality monitoring efforts ● Identifies and describes well heads and public water supplies. ● Identifies and describes groundwater recharge areas contributing to aquifer replenishment, stream base flow, or wetland hydrology. ● Describes demographics, and historic, current, and projected population density. ● Describes historic, current and projected land uses and land cover. ● Identifies water quality classifications for all segments of the waterbody and contributing waterbodies. ● Identifies and describes impairments to water quality and living resources. ● Describes living resources (e.g., fish, macroinvertebrates), and overall watershed habitat including invasive species concerns. ● Describes key water and habitat resources warranting special protection or restoration. ● Describes a projected build-out for the community(ies) based on current land use plans and regulations. ● Estimates impervious cover for each subwatershed. ● Estimate runoff and pollutant loadings for each subwatershed under current conditions, and anticipated pollutant loads resulting from new or expanded uses in the watershed based on the water quality modeling.

Other watershed-scale and conservation plans

Many types of planning processes can support watershed management and conservation work in the Hudson River watershed. These range in scale, whether focused on a watershed, a site or reach, a municipality, a county, or a broader look at the region.

Many Hudson Valley municipalities have developed Natural Resource Inventories (NRIs) to support local conservation planning. NRIs are similar to watershed characterizations in that they compile and describe important, naturally occurring resources within a given locality ([Haeckel & Heady 2014](#)). Similar to how a watershed characterization can provide the foundation for a watershed plan, an NRI can provide the foundation for an [Open Space Plan](#), which develops strategies to conserve priority natural areas.

There are also some key differences. While NRIs can be conducted at a watershed scale, they are often focused on understanding the status of the natural environment at a municipal scale, and can include one or two towns, cities, villages, or counties. Watershed characterizations are usually more focused on the status of the water, as well as land-based features that affect the water. Watershed characterizations typically include more detailed information about the built environment and potential sources of pollution than an NRI. For more information about NRIs, see the Hudson River Estuary Program's website on [Conservation Planning in the Hudson River Estuary Watershed: Natural Resources Inventory](#) and [Creating a Natural Resources Inventory: A Guide for Communities in the Hudson River Estuary Watershed](#) (2014).

Other watershed-scale planning approaches may be a good fit for addressing local concerns. These include [stream management plans](#) to focus on the stream channel and riparian area (this approach has been utilized for many [Catskills streams](#)), [Resilient NY](#)-style hydrologic/hydraulic plans to address flooding, [Drinking Water Source Protection Program](#) plans for public sources of drinking water, [Natural Resource Inventories](#) or other conservation plans, etc. Many watershed characterizations and/or plans will also need more localized reach-scale or site-specific plans, engineering studies, or designs to move from concept to implementation of projects.

Existing plans that include the specific watershed can be cited and referenced within the watershed characterization, whether those plans, inventories, or designs are smaller or larger than the specific watershed's delineation. The watershed characterization process can also identify planning gaps, where additional site-scale, municipal, watershed, or regional planning would support either a better understanding of current conditions or future implementation of projects. These projects can be mutually reinforcing, even if they cover different scales (such as watershed or municipality). Having an existing municipal or county-scale NRI report and/or GIS data already compiled and organized can be very helpful for a watershed characterization, and vice versa. Any plan that includes an inventory of information can support future plans working in a similar geography.

Key Points

Key points from Chapter 2: Watershed Planning Frameworks include:

- A watershed plan is a long-term, comprehensive roadmap of actionable steps that can be implemented within a watershed to address identified challenges. Planning follows a three-step process: start by understanding current conditions, set goals for future conditions, and identify strategic actions to get from the present to the future.
- The two primary frameworks used for locally-led watershed planning in New York State are 1) the US EPA's 9 Element watershed plan, which has been adopted by and incorporated into NYS DEC's Clean Water Plan framework, and 2) the New York State Department of State's watershed management plan.
- In each planning framework, watershed characterization serves as the foundational or "inventory" phase of the broader management and planning effort. US EPA, NYS DEC, and NYS DOS provide watershed characterization guidance in their respective watershed planning and management guides.
- While the frameworks share the same general approach to the watershed planning process, one may be a better fit for a particular set of challenges and goals. If a complete watershed plan is a long-term goal, knowing the requirements of the watershed characterization within each planning framework can help get the process started.
- In addition to the 9 Element and NYS DOS watershed planning frameworks, there are many other types of planning processes that can support watershed management and conservation work in the Hudson River watershed. These can include a Natural Resource Inventory (NRI), stream management plan, Resilient NY or other flooding plan, or Drinking Water Source Program Plan (DWSP2). An existing plan can inform, be included, or be cited in the watershed characterization. The watershed characterization process can also identify gaps where another type of planning would be beneficial.

Chapter 3: Watershed Characterization Process: Getting Started

Before the watershed characterization process of compiling information and data even begins, it is important to clarify the project's purpose, scope, and audience. This includes understanding motivations (why), geography and scale (where), the content focus (what), and building the team (who). Clarifying these details lays the groundwork before starting the project to fine-tune the scope, which can save time and money and make the final product more useful.

This chapter provides resources and information to help scope the watershed characterization project, before collecting data and engaging the broader community beyond the project team. This starts by understanding why a watershed characterization is needed, how it might be used, and by whom. The watershed characterization approach is flexible, and can be scaled to the watershed size, issues, or resources available.

The purpose of the characterization will inform the geographic extent of the project and watershed boundary, as well as the focus of the content, so that the project is manageable. A project that may seem small in scope at the start can easily grow as work gets underway, so having a clear set of goals will help the project team come back to the central purpose, especially if the scope is expanding or drifting. Projects may also have larger than anticipated budgets, especially if specific professional skills are needed on the project team. These details will help determine the right approach, the form of watershed characterization products, project team members, their roles, and specific process elements, which will make it easier to estimate project costs and timelines. Having a clear scope of work and associated budget will also make it easier to complete funding applications to develop the watershed characterization.

To help think through the purpose and scope of a watershed characterization, Karen Strong of Strong Outcomes, LLC developed self-assessment worksheets for the Hudson River Watershed Alliance. In particular, [Worksheet 2: Preparing to Begin a Watershed Characterization or Plan](#) is designed for individuals and local groups preparing to start a watershed characterization to think through their approach and choose a focus and process that best meets their needs. For more information on the worksheets, see [Appendix E: Worksheets to Identify Watershed Characterization/Planning Next Steps](#).

Additional guidance for determining watershed planning scope and purpose is available in the US EPA's [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#), especially [Chapter 4: Define Scope of Watershed Planning Effort](#) (US EPA 2008), which provides detailed recommendations and prompts, including identifying issues of concern, defining the geographic extent of the watershed, and developing preliminary goals.

Watershed characterization process overview

There are several steps that are typically part of creating a watershed characterization, after clarifying the initial purpose, scope, and audience for the project.

These include:

- Creating an advisory committee, and meeting regularly over the course of the project to guide the process and keep it grounded in local priorities;
- Collecting, compiling, reading, and organizing relevant information and GIS data for the report narrative and maps;
- Creating maps, summary statistics, and/or other visuals that illustrate current watershed conditions and share relevant information;
- Writing the report narrative to summarize, cite, and analyze information; and
- Formatting, publishing, and sharing the watershed characterization products.

Each of these steps will be informed by the specific priority outcome and watershed goals, including whether a specific watershed planning framework is being followed. For more information on specific watershed planning frameworks' watershed characterization process, see [Chapter 2: Watershed Planning Frameworks in New York State](#).

More information about specific roles of project team members, including the advisory committee, is described below in the Chapter 3 subsection, [Building the team](#). More details on the steps to compile and organize information are included [Chapter 4: Watershed Characterization Process: What to Include](#). The steps to write the report, create visuals, and interpret findings are included in [Chapter 5: Watershed Characterization Products](#).

[Appendix A: Watershed Characterization Templates](#) walks through the process to develop the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization reports, part of the Hudson River Watershed Alliance's watershed characterization pilot project.

Intended outcomes of the watershed characterization process

Developing a watershed characterization can support watershed groups at different stages in their development with different objectives. A watershed group that is just getting started may want to focus on connecting people from across the watershed to build stronger relationships and a shared understanding of watershed conditions through both the process and the product. An established watershed group that has a lot of different existing reports or data may benefit from a focus on bringing different information sources into one place to understand and inform next steps, emphasizing the value of organizing files and having a citable product. Watershed groups may also be interested in piloting a watershed planning process by starting small, with just the watershed characterization, and building their capacity for a complete watershed plan.

Regardless of the group's stage, it is important to consider what you specifically hope to accomplish through this project. A variety of outcomes can be well-served by a thoughtfully planned and designed watershed characterization process. Understanding the range of possible outcomes and then specifying project priorities often results in a more useful, impactful process and product.

Possible outcomes of the watershed characterization product can include:

- Documenting institutional memory to capture what is currently known about the watershed and share information more easily with existing watershed group members, new members or partners, and to build support;
- Organizing a “reference library” of previously disparate information, which becomes easy to find, reference, and cite;
- Defining problems as the foundation for a watershed planning process, saving money and time in the future; and
- Increasing legitimacy of local watershed work, with a publication endorsed by various partners and experts on the project team.

Possible outcomes of the watershed characterization process can include:

- Stronger cross-watershed relationships with municipalities, local organizations, and regional partners for future collaboration;
- Increased public awareness of the watershed and its issues or challenges;
- Broader support for other aligned local plans, practices, and projects that support watershed health;
- Increased capacity of the watershed group, through stronger relationships and systems; and
- Increased self-efficacy of the watershed group, by knowing what information they have and where to find it, to rely less on others.

For more details on the benefits of developing a watershed characterization, see the Chapter 1 subsection [Benefits of watershed characterization](#).

The specific purpose of a watershed characterization will inform its structure and the approach to writing and presenting information. For example, a watershed characterization with a primary goal of compiling and sorting information will likely be a longer report and include more jargon. While this type of product may be less publicly accessible, it may be a helpful step before a separate product that tells the story in plainer language. Having a report that goes deep into specific topics can be a helpful step before summarizing that information succinctly and accurately for a more public-facing audience. A watershed characterization designed to serve as an educational tool or to build public support will look and feel different. (For an example, see Groundwork Hudson Valley’s 2019 [State of the Saw Mill River Watershed](#) report.)

Clearly defining the intended audience for the watershed characterization, including who would be reading or using it for next steps, is an important step in this process ([Shilling et al. 2004](#)). Potential audiences may include watershed group members, municipal officials, regional partners, watershed residents, community organizations, and more. For support on audience identification, see the Hudson River Watershed Alliance and River Network’s [Organizational Growth Self-Paced Learning Series](#) video on [Communications](#).

A watershed characterization designed to be the first step of a watershed plan should follow the recommended format for that watershed planning framework; for more information, see [Chapter 2: Watershed Planning Frameworks in New York State](#). More information on the range of forms that watershed characterizations can take is in the Chapter 3 subsection, [Watershed characterization products](#). For more information on considering what content to focus on in the watershed characterization, see the Chapter 3 subsection [Watershed characterization focus](#).

For the watershed characterization pilot processes with the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, the Advisory Committees discussed priority project objectives at their respective project kick off meetings. Each watershed and Advisory Committee had slightly different priorities for the process and product, which directly informed the watershed characterization process and product.

In the Punch Brook-Roeliff Jansen Kill watershed, top priorities were compiling disparate information, serving as the foundation for a future watershed plan, and fostering stronger relationships across watershed municipalities. The group wanted to pilot the process in a smaller subwatershed with a focused advisory committee, before developing a complete watershed plan for the larger Roeliff Jansen Kill watershed. While each municipality had active conservation efforts, they were not necessarily connected. To support relationship-building goals, the process included a field trip to the Punch Brook at Drowned Lands Swamp, providing an informal opportunity for the Advisory Committee to get to know each other (Figure 5).



Figure 5. Members of the Punch Brook-Roeliff Jansen Kill Watershed Characterization Advisory Committee visited Drowned Lands Swamp along the Punch Brook on 5/26/23.

In the Sparkill Creek watershed, top priorities were also compiling disparate information and serving as the foundation for a future watershed plan. The Sparkill Creek watershed had been the subject of a vast number of previous plans and studies, and the information available needed to be in one place as a reference library, contextualized by the watershed characterization report narrative. As a result, the project's information compiling process took a broad approach to organizing any relevant information that was available to develop those products. This included a detailed/more technical watershed characterization report narrative with many links to source materials, a Google Drive folder with copies of reports organized by watershed characterization section, and a reference spreadsheet with direct links in one place.

In the Fishkill Creek watershed, the watershed characterization maps were designed to be public-facing materials that start conversations in support of next steps in the watershed characterization and planning process. The Fishkill Creek Watershed Alliance and Clarkson University have used the maps to educate local residents and partners working on Fishkill Creek projects, as part of grant applications to fund watershed projects, and to share with donors to boost stewardship and engagement in their work ([Meierdiercks et al. 2025](#)).

Watershed motivation and goals

In addition to process-based goals and outcomes, there may be specific watershed-based reasons that a watershed group is motivated to develop a watershed characterization.

The [“Watershed Planning 101” webinar](#) hosted by River Network and the Colorado Water Conservation Board (2024) provided a framework for three different types of motivations that launch a watershed characterization or plan:

- Exploratory - Not reacting or anticipating, but planning to better understand conditions.
- Reactionary - Something has happened in the watershed, and you want to address it. What can you do to improve that situation?
- Anticipatory - You know a change is coming to the watershed, and you want to understand baseline conditions before the change occurs.

Another way to frame motivations is to consider what questions you have about the watershed ([Shilling et al. 2004](#)). This could include questions like:

- What is the condition of our watershed, and why is it that way? (Exploratory)
- Why did this water quality or ecological change occur? (Reactionary)
- What impact might this upcoming change have on our watershed? (Anticipatory)

Understanding the project's motivations will help develop a specific statement of purpose, which can serve as the project's goal and ensure that the project team is all on the same page ([Shilling et al. 2004](#)). This will drive what steps take place during the characterization process, what information will be included, how the product will be used, and how that will help support watershed goals ([Shilling et al. 2004](#)). Note that anticipatory and reactionary watershed

characterization may have different specific intended outcomes than exploratory watershed characterizations.

The pilot watershed characterizations in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds were exploratory. As part of the [Application for Technical Assistance](#), the applicant from each watershed briefly described what their watershed was like and what challenges the watershed was facing. This helped the project team orient to the priority issues and content to focus on or include in the watershed characterization. In the Punch Brook-Roeliff Jansen Kill watershed, challenges included increased development during the Covid-19 pandemic, aging septic systems, riparian buffers, and petroleum bulk storage facilities. In the Sparkill Creek watershed, challenges included flooding and water quality, such as nutrients, bacteria, and chemical contamination from past industries.

Goal-setting is a foundational part of the watershed planning process, and can be valuable as part of a watershed characterization. This is especially important to make the most of limited resources and provide a focus for a finite amount of time and budget. Understanding issues of local concern, what the watershed group or community is interested in, and what information is already known can help set initial goals for what the community wants the watershed to be like in the future.

The process for NYS DOS-funded watershed plans include setting an initial vision and watershed goals at the very start of the process, before beginning the watershed characterization. The [Watershed Management Plan – Work Plan](#) (NYS DOS 2026) and [Nine Element Watershed Management Plan - Work Plan](#) (NYS DOS 2026) state:

“The Contractor or its consultant(s), in collaboration with the watershed advisory committee, shall prepare an initial vision statement that expresses an idea of what the watershed will become, and clearly describes what the community hopes to accomplish. The vision will set the tone of the watershed plan and will be used throughout the planning process [including the watershed characterization]. In addition, an initial set of watershed goals and objectives will be created to provide a realistic framework for achieving the vision as well as help focus limited resources.”

The NYS DOS watershed planning work plans also include a step to revisit the vision and goals later in the process, based on public feedback and community engagement. Vision and goal-setting is an interactive and iterative process, and it is important to have an initial sense of the reasons to create a watershed characterization. For more information on the NYS DOS watershed management plan approach to vision and goals, see Chapter 3: Developing a vision and initial watershed goals (pg. 41 of the PDF) in the [Guidebook on Watershed Plans: Protecting and Restoring Water Quality](#) (2009).

Watershed characterization focus

A watershed characterization's content can focus on a number of different watershed conditions or issues. If the characterization is anticipatory or reactionary, there may be specific issues, data, geographic areas, etc. to focus on.

If the watershed characterization is more exploratory, it may take a broader approach. However, since there is so much potential information that it could include, it can still be helpful to focus. Even with a broad view, the project could spend more time compiling and interpreting specific types of information for a particular issue or challenge. It could also focus on a specific geography within the delineated watershed (for example, a watershed's main stem, or riparian area, vs. all tributaries). The watershed characterization approach can also be scaled to the watershed, issues, or resources available.

Some watershed characterizations have a very narrow purview on land use impacts on water quality, especially focused on nonpoint source pollution. These often focus on specific water quality parameters, such as nutrients or sediment. Others have a broader scope for communities to define the watershed-based issues that are important to them and tell a wider range of stories. These can include flooding, climate change, aquatic and/or terrestrial ecosystem health, access and recreation opportunities, environmental justice considerations, and more.

For example, the [2010 Bronx River Intermunicipal Watershed Management Plan](#) (and its embedded watershed characterization) focused on disturbed hydrology, impaired water quality, aging infrastructure, invasive vegetation, degraded habitat, and dams/habitat connectivity. In 2024, the Bronx River Alliance updated the plan to address major gaps in the plan, including a new focus on climate change adaptation and environmental justice. This resulted in an updated watershed characterization that compiled information focused on social vulnerabilities of the watershed communities and climate change risks to the watershed. More details on this process are available in the 2025 webinar "[Community-Led Efforts to Improve Climate Resilience in the Bronx River Watershed](#)" presented by Christian Murphy from the Bronx River Alliance and the [Bronx River Alliance's website](#). Both the 2010 and 2024 Bronx River watershed management plans were funded by NYS DOS Local Waterfront Revitalization Program grants.

Whether the watershed characterization is broad or narrow, understanding its area of focus will help determine the expertise and experience needed on the project team, along with the project's timeline and budget/funding.

Determining the watershed boundary

While selecting the watershed for the characterization may seem straightforward, it is a significant step that often requires thoughtful consideration. Confirming the geographic extent

of the characterization and the watershed boundary are decisions to be made by the project team and/or advisory committee.

Watershed boundaries can be delineated at a wide range of geographic scales or sizes and through different processes. The size will impact the scope of the characterization, what data to include, and who will participate in the watershed characterization process. Once a geographic scale has been determined, there are three options to identify the specific watershed boundary for the characterization:

1. Use an existing watershed boundary
2. Create a new one, using a tool like StreamStats
3. Use a Hydrologic Unit Code (HUC)

It is important to confirm the best and most appropriate delineation for the characterization project. Many watersheds are not strictly based on topography, and the built environment may result in water moving across topographic boundaries in surprising ways; this may include drinking water supplies; stormwater infrastructure; inter-basin transfers that move water from one watershed to another using pipes, canals, or aqueducts; and other ways and places that impact how water actually flows across the landscape ([Meierdiercks et al. 2024](#)). Modifying topographically-defined watersheds to include these details is especially important when these areas are a significant portion of the watershed's total acreage, such as in smaller watersheds.

Regardless of the process used to identify the watershed boundary, it should be clear in the watershed characterization how the boundary was created. For example, NYS DOS-funded watershed characterizations and plans must clearly describe the watershed delineation process, so that it can be replicated and mapped on the NYS DOS Geographic Information Gateway map [“Watersheds with a Watershed Management \(WMP\) or Nine Element \(9E\) Plans, 2010-Present.”](#)

Geographic scale considerations

Geographic scale refers to the size of the watershed. The watershed boundary should be appropriately scaled to match the project goals and available resources. For both the maps and the report narrative, the scale of the watershed will impact what data can be mapped, what information should be included, and how much generalization is needed ([Meierdiercks 2025](#)).

In the US EPA's [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#) (US EPA 2008), [Chapter 4: Define Scope of Watershed Planning Effort](#), includes a discussion of identifying the right scale. Chapter 4 states: “The key to selecting the geographic scope of your planning effort is to ensure that the area is small enough to manage but large enough to address water quality impairments and the concerns of stakeholders.”

The scale of the watershed will inform, and be informed by, the issues that the watershed characterization will focus on. [Vail et al. 2024](#) note that: “Different watershed issues may emerge at different geographic and temporal scales. For example, watershed priorities within a

small tributary may be different than those impacting the larger main-stem river; however, all issues are connected to the broader watershed ecosystem. A smaller watershed focus may be best-suited to having more local involvement, while larger watersheds may include broader expertise to tackle more challenging problems.”

[Chapter 1: Introduction](#) in the [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#) (US EPA 2008) also discusses the importance of finding the right watershed scale that is not too large: “...the scale should not be so large that it hampers the ability to conduct detailed analyses or minimizes the probability of involvement by key stakeholders and successful implementation. If you select a scale that is too broad, you might be able only to conduct cursory assessments and will not be able to accurately link the impacts back to the sources and causes.”

The watershed should also not be too small. [Chapter 1: Introduction](#) of the 2008 US EPA *Handbook* describes: “...the general intent is to avoid a focus on single waterbody segments or other narrowly defined areas that do not provide an opportunity for addressing watershed stressors in a rational, efficient, and economical manner... Plans that bundle subwatersheds with similar sets of problems or address a common stressor (e.g., sediment, nutrients) across multiple related watersheds can be particularly useful in terms of planning and implementation efficiency and the strategic use of administrative resources.”

It may also be valuable to group hydrologically separated but adjacent small watersheds that are facing similar challenges together for a watershed characterization. For example, while the Saw Kill Watershed Community has focused their work on the Saw Kill watershed, their program area also includes the Stony Kill watershed to the north and the Mudder Kill watershed to the south ([Saw Kill Watershed Community 2022](#)). Although these are each separate tributaries, these watersheds include the same municipalities and face similar challenges.

For the pilot watershed characterization project, the project team intentionally selected watersheds that were relatively small in size, while being large enough to have enough available information to work with. This was driven by the resources available, including timeline, budget, and expertise on the project team. The pilot project set a threshold for participating watersheds to be HUC (Hydrologic Unit Code) 12 size or smaller. While HUC 12 watershed sizes vary depending on the specific watershed and waterbody, they are generally about 36 square miles in area. (For more information on HUCs, see the Chapter 3 subsection below, [Using a Hydrologic Unit Code](#).) Eligible watersheds also needed to be large enough to include more than one municipality (town, city, or village), especially as one of the project goals was to foster connections across municipalities. The Punch Brook-Roeliff Jansen Kill watershed (HUC 12) was 47.5 square miles (including six municipalities across two counties) and the Sparkill Creek watershed was 11.2 square miles (including six municipalities across two counties/states).

During each pilot watershed’s kick off meeting, the project team shared existing mapped watershed boundary options with each advisory committee to discuss and determine which

would be the best fit for the project. For the Punch Brook-Roeliff Jansen Kill watershed, the Advisory Committee wanted to focus on the Punch Brook-Roeliff Jansen Kill hydrologic unit (HUC 12), rather than a topographically-delineated watershed for the Punch Brook as a tributary to the Roeliff Jansen Kill (Figure 6). For the Sparkill Creek watershed, the discussion included how much to prioritize information about Piermont Marsh, a tidal wetland at the mouth of the creek where it meets the Hudson River, and how much of the marsh's area impacts Sparkill Creek conditions.

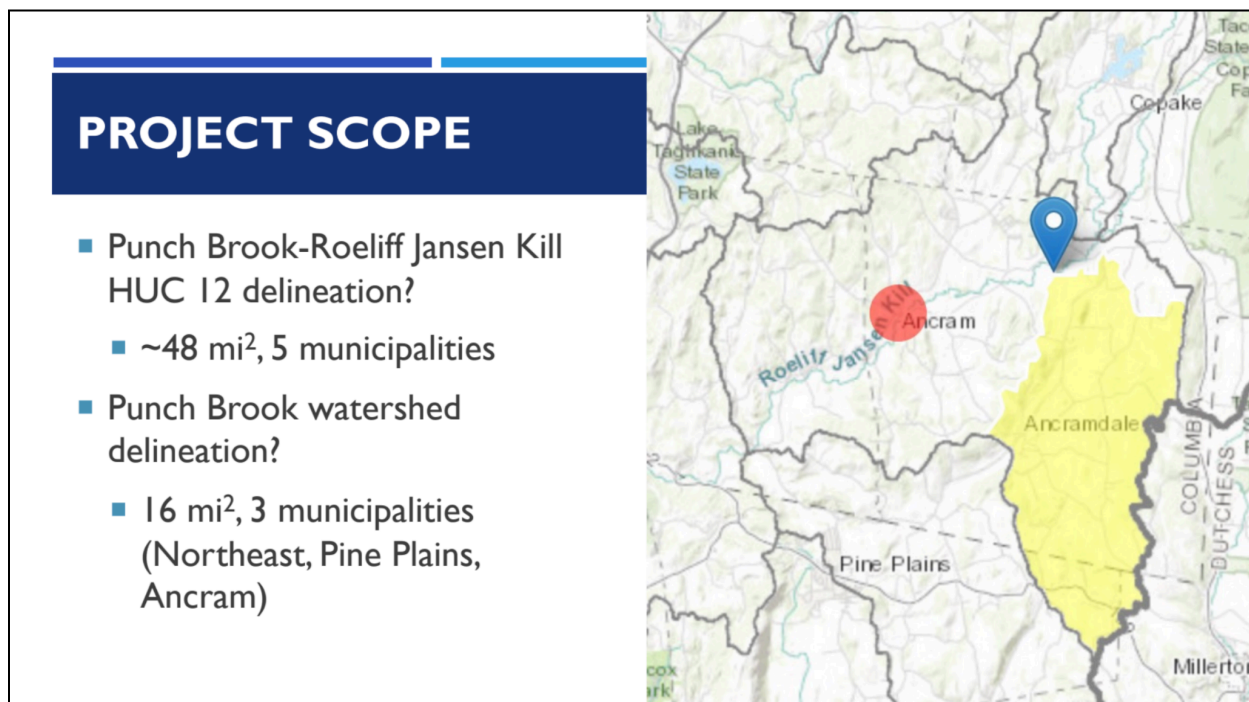


Figure 6. Slide from the Punch Brook-Roeliff Jansen Kill watershed characterization project kick off meeting presentation, clarifying the watershed delineation to use as part of the pilot project. The yellow area is the Punch Brook subwatershed, within the Punch Brook-Roeliff Jansen Kill HUC 12 outlined in gray.

Using an existing watershed delineation

It can be valuable to use an existing digitally-mapped watershed delineation to ensure that a consistent watershed area is being considered. Counties or other entities may have mapped watershed boundaries, or they may be available from previous planning efforts. This ensures that the watershed boundary and corresponding area match with other programs or plans.

For the Sparkill Creek watershed characterization, the project team used a watershed delineation that had been created for the Sparkill Creek's [Resilient NY](#) flood study (SLR Consulting 2022). This Flood Mitigation & Resilience report had just been completed at the time that the watershed characterization process was beginning, and was considered the most

up-to-date delineation. This ensured that the watershed characterization's area and summary statistics aligned with the information in the flood study.

Delineating a new watershed boundary

If an appropriate watershed delineation doesn't already exist, the team may need to delineate a new watershed boundary. The US Geological Survey (USGS) [StreamStats](#) application is a useful tool for this. After selecting a watershed outlet point, StreamStats delineates the watershed area as a polygon GIS layer, based on topography data. More advice on delineating a new watershed boundary is available in the "[Watershed Characterization Guidance Document for Students and their Mentors](#)" (Meierdiercks 2025).

Using a Hydrologic Unit Code

A Hydrologic Unit Code may also be an appropriate watershed delineation. The USGS uses [Hydrologic Unit Codes](#) (HUCs) to map and identify specific watersheds at a variety of scales. The USGS has divided and subdivided the land area of the United States into successively smaller hydrologic units, often referred to as "HUCs," which are classified into different levels. The larger the number of digits in a HUC, the smaller the size and geographic scale of the watershed. The largest-sized watersheds are classified with two digits and are referred to as "HUC 2s," while the smallest watersheds, "HUC 12s," are classified with 12 digits.

While the terms Hydrologic Unit Codes and watersheds are used interchangeably, a hydrologic unit may not be a true, topographically-defined, watershed. For example, a single watershed may be divided into two adjacent but separate HUCs, even if they are hydrologically connected. Thus, waters may flow into a hydrologic unit from an upstream hydrologic unit, even though they are depicted as separate HUCs. For more discussion on watersheds versus hydrologic units, see [Meierdiercks et al. 2024](#) and [Omernik et al. 2017](#).

Many Hudson River tributaries are mapped at the HUC 10 scale. Those watersheds are further subdivided into smaller HUC 12 areas. Maps of HUC 10 and HUC 12 delineations for the Hudson River watershed are available on the [Hudson River Watershed Alliance's website](#).

The Punch Brook-Roeliff Jansen Kill watershed characterization boundary was a HUC 12. The local lead and Advisory Committee selected this area because it was the largest HUC 12 of the larger Roeliff Jansen Kill (HUC 10 scale) watershed, centrally located, had representative land use for the watershed as a whole, and included much of the Town of Ancram, where there was local support and leadership. This HUC 12 size was the right scale for local goals of piloting the watershed characterization process and building stronger relationships across municipalities. While the watershed characterization acknowledged that this middle section of the larger Roe Jan watershed is influenced by conditions upstream, and influences conditions downstream, the watershed characterization report and maps focused on information available within the specific HUC 12 boundary.

For the Fishkill Creek watershed characterization mapping project, the HUC 10 watershed boundary was compared to a topographically-derived boundary, delineated using Streamstats with the watershed outlet where the Fishkill meets the Hudson. The boundaries were determined to be identical.

Watershed characterization products

Watershed characterization products can take a range of different forms, depending on the project scope, intended outcomes, and audience. These can be more polished products, or “working documents” that are in more of a useful draft form that may be updated over time.

Some formats of watershed characterization products may include, with examples:

- PDF reports with written narrative and embedded map illustrations, such as:
 - [Punch Brook-Roeliff Jansen Kill Watershed Characterization Report](#) (Hudson River Watershed Alliance 2024)
 - [Sparkill Creek Watershed Characterization Report](#) (Hudson River Watershed Alliance 2024)
 - [Pocantico River Watershed Characterization Report](#) (Pace University 2024)
- PDF report cards or “state of the watershed”-type reports, such as:
 - [State of the Saw Mill River Watershed](#) report (Groundwork Hudson Valley 2019)
 - [State of the Hudson 2020](#) report (Hudson River Estuary Program, NY-NJ Harbor & Estuary Program, and NEIWPCC 2020)
- Interactive websites, such as:
 - [State of the Estuary 2025](#) interactive website (Hudson River Estuary Management Program and NY-NJ Harbor & Estuary Program 2024)
- Story maps, such as:
 - [Pocantico River Watershed Characterization](#) (Pace University 2024)
- Interactive webmaps, such as:
 - [Saw Kill Watershed Community Database](#) (Bard College Center for Environmental Science & Humanities 2026)
- Series of PDF maps, such as:
 - [Fishkill Creek watershed characterization maps](#) (Fishkill Creek Watershed Alliance 2024)

One of the values of a watershed characterization is having a product that can be clearly cited, with an author and a date. It should also serve as a reference for future decision-making, including, but not limited to, a watershed plan. There may be other creative approaches to consider outside of a specific publication, such as a series of academic-style posters, an event with presentations that share updates on current conditions, a tour of the watershed that highlights what is known, or other storytelling approaches. It is important to consider how information about current watershed conditions can best be compiled and shared to best achieve local goals.

When considering both the process and products, the project team may discuss if and how Generative AI (GenAI) might be used to make a watershed characterization product. GenAI is increasingly available, and is a powerful tool that can aggregate and synthesize large volumes of information across disparate sources. The capabilities of GenAI will undoubtedly cause some to ask why it is worthwhile to go through the lengthy process of compiling, synthesizing, and interpreting existing information to understand current watershed conditions, and then generating narrative, maps, and other tools to tell the watershed's story, when these tasks could be completed using GenAI. (Although at the time of writing, we are not aware of a watershed characterization that has been completed solely using GenAI.)

While completing some preliminary work using GenAI may be helpful to build momentum for watershed characterization or to demonstrate the process to funders or partners, it is important to point to the many purposes and outcomes of the watershed characterization process described above. There is significant value in learning by doing, including reading and understanding source material and participating in active decision-making. The purpose of completing a watershed characterization is not just to have the final watershed characterization document, but all of the shared learning and partnership-building that happens while reviewing information and creating the watershed characterization document. Furthermore, the important but often hidden decision-making that happens throughout the process to ensure that the watershed characterization is both usable and used by the community is lost when partners are not actively involved in the creation process. Generative AI tools are also known to make many mistakes, and any AI-generated products should be carefully reviewed to ensure accuracy.

If a project team uses AI, it is important to be transparent and accountable. The American Association for the Advancement of Science's [Science journals' guidelines for AI usage](#) is a helpful reference for considering how AI can be cited as a tool in different contexts.

Building the team

A watershed characterization is always a team effort. Clarifying who might be involved, and how, helps local watershed groups identify and recruit project leaders, advisors, volunteers, regional organizational partners, and/or consultants, as well as the communities you will seek to engage in the process.

Most watershed characterizations will have a "project team" of one or more people that create the characterization products, a project manager to guide the process, a local lead to connect to and represent local priorities, and an advisory committee to provide feedback. Other roles may depend on the watershed characterization goals, budget, and what expertise is needed to be successful.

Who to include

There are possible roles available for a wide range of different types of people, with different affiliations, experience, and expertise. It is important to understand who is committed to participating, why they are personally or professionally interested in the watershed characterization process, and what role(s) they are well suited to playing, whether volunteers or paid staff or consultants.

Casting a wide net regarding participation can help understand who is interested in participating, what skills or strengths they can bring to the effort, what role they might play, and where there may be gaps that can be supported through consultants, partners, or additional team members. Everyone who participates in the watershed characterization process should have a specific reason to be there, and it should be clear how their participation will benefit them ([River Network & Colorado Water Conservation Board 2024](#)). The process may benefit from having project team members talk to potential participants ahead of their involvement to understand what issues are important to them, how this project may serve them, and what role, if any, they might be interested in or available to play ([River Network & Colorado Water Conservation Board 2024](#)).

US EPA's [Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#) provides additional recommendations and prompts to support developing the project team in [Chapter 3: Build Partnerships](#) (US EPA 2008). The *Handbook* also includes a [worksheet in Appendix B](#) to identify skills and resources from participants in a watershed planning process, which can also be used for watershed characterization ([US EPA 2008](#)).

Generally, people who are valuable to include in a watershed characterization process in some role or capacity include:

- People that can provide information and data related to current watershed conditions,
- People that understand community interests and concerns in the watershed,
- People that are involved with or know about other programs or plans related to watershed management,
- People that can provide technical expertise to understand current watershed conditions,
- People that can use the watershed characterization to implement next steps, and
- People that would be affected by the implementation of those next steps ([US EPA 2014](#), [River Network & Colorado Water Conservation Board 2024](#)).

To help individuals or organizations (especially regional partners) who are interested in supporting a locally-led watershed characterization to identify the different types of contributions they can make, Karen Strong of Strong Outcomes, LLC developed the self-assessment [Worksheet 1: Supporting Watershed Characterization or Planning](#). For more information on the worksheets, see [Appendix E: Worksheets to Identify Watershed Characterization/Planning Next Steps](#).

Project team roles

The project team is the group of people that prepares materials for the watershed characterization. This can include work towards the *product*, including compiling, documenting, and organizing information; preparing maps and summary statistics; writing the report narrative; interpreting information; the design and formatting of products; community presentations; and so on. This can also include work towards the watershed characterization *process*, including preparing project team and advisory committee meeting agendas and other materials, facilitating meetings, coordinating with the team, and, if applicable, grant reporting and administration. The project team may include paid consultants to provide specific expertise.

When possible, it is valuable to have a diversity of expertise and perspectives on the project team. [Meierdiercks et al. 2025](#) notes that, “Teams are needed with not only technical experts and community members with local knowledge, but also project leaders who can provide vision and direction, project managers to help the team meet that vision, and effective listeners and communicators to both help translate technical information to diverse stakeholders and to tell the story of the watershed.”

Members of the project team may be paid for their work, or they may serve as volunteers. If they are unpaid, it is important to consider what value they receive from their work. For example, work on a watershed characterization may provide college students with course credit, educators with community-oriented teaching opportunities, and regional partners or agency staff with work that aligns with their job duties.

Generally, a project manager provides administrative leadership and coordination across the watershed characterization process and serves on the project team ([Shilling et al. 2004](#)). The project manager who guides the process may be a regional partner, or they may serve as the local lead. Depending on the project’s scope and budget, the project manager may also be the primary or only preparer of materials.

For the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization pilot projects, Emily Vail, Executive Director of the Hudson River Watershed Alliance, served as the project manager. The Hudson River Watershed Alliance prepared and facilitated meetings, and coordinated closely with the project team, advisory committee, and project funders at the Hudson River Estuary Program and NEIWPCC. In addition to managing the process, the Hudson River Watershed Alliance prepared most of the watershed characterization report, including gathering information and leading writing on the report.

The project team also included Karen Strong from Strong Outcomes LLC, who advised on the watershed characterization process, assisted with meeting agenda preparation and facilitation, and supported writing and clear communication in the watershed characterization report. Strong Outcomes brought extensive experience with local conservation planning, including expertise on information and datasets that was different from the expertise of the Hudson River

Watershed Alliance. Having different disciplinary expertise and experience on the project team helped to better compile and understand different sources of information. Tracey Ledder, Hudson River Watershed Alliance board member and Senior Scientist at Delaware Engineering, provided volunteer time to assist with reviewing information for both watersheds, developing the required secondary data Quality Assurance Project Plan (QAPP), and ensuring that the project followed the QAPP (for more information, see the Chapter 4 subsection [Organizing and documenting information](#)).

The project team for both watersheds also included a local champion/point person: Colleen Lutz from the Town of Ancram and Roe Jan Watershed Community for the Punch Punch Brook-Roeliff Jansen Kill and Larry Vail from the Sparkill Creek Watershed Alliance for the Sparkill Creek. In each watershed, the local lead submitted the original application for technical assistance, assembled the representatives on the advisory committee, had 1:1 calls with the project manager to check in and provide more targeted advice, provided feedback on the watershed characterization process and product, organized logistics for the community presentation at the end of the project, and presented at the community presentation. At the start of the project, each local lead signed a Memorandum of Understanding (MOU) with the Hudson River Watershed Alliance that outlined expectations and served as a mutual commitment to the project. (For an example, see the [Sparkill Creek Watershed Alliance Watershed Characterization Technical Assistance letter](#).)

To create maps, the project team hired Green Goat Maps (previously known as Adirondack Research), a private consulting firm. Katherine Meierdiercks, Hudson River Watershed Alliance board member and Professor of Environmental Studies and Sciences from Siena University, provided additional support on managing GIS data and developing summary statistics as a volunteer.

The Fishkill Creek watershed characterization mapping project also included a project team with specific roles (Table 3). The Hudson River Watershed Alliance convened the project team, based on existing relationships with each team member, and the academic faculty mentor selected the undergraduate student partner ([Meierdiercks et al. 2024](#)). Due to the timeline and more limited scope of the Fishkill Creek watershed characterization mapping project, the team did not include an advisory committee. Instead, Sergei Krasikov, President of the Fishkill Creek Watershed Alliance, served as a liaison back to the watershed group. Planned next steps for the watershed characterization include a more formal advisory committee to further develop the maps and compile additional information for the report.

Clarity of roles and expertise on this project supported efficiencies, with each project team member leaning into their strengths. [Meierdiercks et al. 2025](#) observed that: “Including Beacon Institute and HRWA staff as part of the project team provided not only local but regional knowledge, institutional memory, and project management support. Furthermore, the administrative and management support they provided meant the student partner and his

faculty mentor could focus on mapping. Meanwhile, the FCWA focused on providing iterative feedback to ensure the maps were accurate and useful for education and planning.”

Table 3. Fishkill Creek Watershed characterization mapping project team members and roles. Table adapted from [Meierdiercks et al. 2024](#).

Team Member	Expertise, Role, and Responsibilities
Charles Gaffney, <i>Undergraduate student, Siena University</i>	Gaffney provided technical expertise in GIS and cartography, and capacity to find and compile available data, and generate and edit watershed characterization maps.
Emily Vail, <i>Executive Director, Hudson River Watershed Alliance</i>	Vail contributed expertise in collaborative processes and project management, setting the structure for meeting agendas and facilitating team meetings. She provided institutional memory and shared lessons learned and experiences from the watershed characterization pilot projects. Vail provided access to a regional network, which can provide valuable information, resources, and potential partners, and helped connect Gaffney to local data.
Kate Meierdiercks, <i>faculty member, Siena University</i>	Meierdiercks mentored student partner, Gaffney; contributed expertise in GIS and working with students and community partners; and served as a “technical translator” between the language of GIS and watershed work.
Sergei Krasikov, <i>President, Fishkill Creek Watershed Alliance</i>	Krasikov provided local leadership and local knowledge of watershed group needs and planning priorities, local knowledge of “markers” to include in the maps, and served as a liaison to the Fishkill Creek Watershed Alliance.
Asher Pacht, <i>Director of Environmental Programs, School(s) Institute for STEM Education, Beacon Institute for Rivers and Estuaries at Clarkson University</i>	Pacht provided local leadership, local administrative and management support, and organizational capacity and resources, including human resources staff and systems to compensate team members through Clarkson University’s payroll (which a volunteer group like FCWA did not have access to). Pacht provided local knowledge of watershed group needs and planning priorities, and local knowledge of “markers” to include in the maps.

Working with consultants

There is a lot that volunteers can do on their own, and it may also be helpful to hire professionals to support the watershed characterization project. It is important to consider what specific expertise or skill sets are needed, and how best to meet that need. Some of the skill sets that are valuable to support through a paid consultant could include project management, meeting facilitation, GIS analysis, cartography, compiling and organizing information, writing, interpretation, analysis, communications, community engagement, or others. There may be value in having a neutral facilitator to manage the process, including ensuring that people can meaningfully participate in the project, along with a consultant with technical expertise to help understand and share information ([River Network & the Colorado Water Conservation Board 2024](#)). The right roles will depend on the specific project’s objectives, along with available funding.

Paid consultants will need a budget and clear scope of work, including deliverables, timelines, and expectations, to execute a contract. Consultant fees can add up quickly, so it is important to track roles and costs to stay on budget. It will also be important to clarify payment terms and timing with consultants, especially if the watershed characterization is funded by a reimbursement-based grant.

For the pilot watershed characterizations in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, the Hudson River Watershed Alliance served as a paid consultant. The Hudson River Watershed Alliance also hired a consultant with expertise in facilitation and conservation planning (Strong Outcomes, LLC) to advise on the project, support Advisory Committee meeting facilitation, and write sections of the watershed characterization narrative where the Hudson River Watershed Alliance staff had less technical expertise.

One of the objectives of the watershed characterization pilot project was to create high-quality maps that could serve as templates for future work. To support this goal, the project team prioritized using available funding to hire a GIS consultant. After issuing a [Request for Qualifications: GIS Consultant](#), the team selected Green Goat Maps because of their expertise with cartography and design.

In contrast, the Fishkill Creek watershed characterization mapping project sought to better understand how an academic-community collaboration might provide a more cost-effective approach to creating watershed maps. Having access to GIS software and skills is important to the watershed characterization process, and not all watershed groups have the resources available to hire a GIS professional for their watershed characterization project. [Meierdiercks et al. 2025](#) notes: “... while there are free and publicly available GIS resources available to community groups, watershed group members may not have the time, computing resources, capacity to learn or use the software, or familiarity with datasets and approaches to watershed-scale mapping. One of the powerful things about completing watershed characterization through academic-community partnerships is the ability for the watershed community to be in the right role, for example, uplifting local feedback in support of local goals, rather than trying to manage this GIS work on their own.”

Academic-community partnerships can be mutually supportive, providing students with unique opportunities to engage in local planning opportunities, while providing the needed skills for community members to move forward with prioritizing watershed work. The Fishkill Creek watershed characterization project partnered with an undergraduate student from Siena University to compile GIS data and create a series of watershed maps. The student researcher was hired by Clarkson University over the course of 10 weeks in summer 2024 and completed the project for course credit.

GIS mapping by academic partners can be a particularly effective tool for supporting community planning, education, and activism efforts ([Lively et al. 2026](#)). Academic-community partnerships

have the potential to provide a mechanism for creating high-quality and customized maps ([Meierdiercks et al. 2025](#)) at a scale necessary to meet the watershed management needs in the region. For more information and advice on working with students, see [Appendix F: Resources to Engage Students in Watershed Characterization Projects](#).

Advisory Committee

The watershed characterization's advisory committee advises on the process to ensure it will be impactful for local priorities and goals. The advisory committee also advises and provides feedback on project materials, ensuring that they reflect community interests and needs and align with larger goals. Their discussion and decision-making sets the course for the watershed characterization process and product, grounding the project in local interests and needs (see [Chapter 3: Intended outcomes of the watershed characterization process](#)). Clearly defining roles, time commitments, and expectations will help people comfortably participate in a way that best takes advantage of their strengths and capacities ([US EPA 2008](#)).

The advisory committee can include both watershed community representatives and technical experts. It is important to have a diversity of expertise, roles, and perspectives represented. Local and regional partners, people with an interest in implementing next steps, people who can provide context for information or data, and people connected to different constituencies are all valuable to include. Depending on the project scope, advisory committees may have subcommittees, such as a technical advisory subcommittee and/or a public engagement subcommittee ([Shilling et al. 2004](#)). In addition to the resources in the above subsection on Building the Team, the NYS DOS's [Waterfront Advisory Committee: Membership and Responsibilities](#) handout provides a useful framework to consider. Several NYS DOS planning processes require an advisory committee, including watershed planning projects.

In assembling the advisory committee, it is also valuable to understand jurisdictions and roles within the watershed, so that the right people are at the table to build consensus and relationships from the beginning. For example, municipalities in New York State have local land use authority, so having at least one representative from each municipality within the watershed can be valuable. For the Sparkill Creek watershed characterization, the Rockland County Drainage Agency also has a unique role in managing rivers and streams, and they were important to connect to in the context of the project.

The advisory committee meets at regular intervals with the project team over the course of the project to move the work forward. Advisory committee meetings should be framed around decision-making points and providing specific feedback on both the process and key deliverables, including maps, what information is included, the report narrative, and interpretation or analysis. If intended outcomes of the watershed characterization process include growing stronger relationships, support, and trust across the watershed, advisory committee meetings and approaches should incorporate opportunities for people to connect and get to know each other's work and priorities.

Advisory committee members are often volunteers, but they could also be compensated for their time through a stipend or honoraria. The time that volunteer advisory committee members contribute is valuable, and can count towards match requirements of grants, based on an hourly rate and the total number of hours contributed in-kind.

For the Punch Brook-Roeliff Jansen Kill and Sparkill Creek pilot watershed characterizations, the local lead in each watershed identified and invited an initial set of advisory committee members as part of the application for technical assistance. Each advisory committee member signed and submitted a letter of support as part of the application. They agreed to attend regular project meetings and assist with gathering data, engaging communities, identifying additional stakeholders to participate in the advisory committee, and supporting an inclusive process. (For more information, see the [Letter of Support Template](#) that was part of the Watershed Characterization: Request for Applications for Technical Assistance package.) During each project kick off meeting, the project team confirmed advisory committee roles and checked if any additional partners should be invited to participate.

The advisory committees included both local and regional representatives, including people with technical expertise. Across the two watersheds, advisory committee members included leaders of local watershed groups, members of municipal Conservation Advisory Councils and Climate Smart Communities Task Forces, municipal elected officials, municipal staff, county agency staff, faculty and staff from academic institutions, land trust staff, Cornell Cooperative Extension staff, and NYS DEC Hudson River Estuary Program staff, who funded the project.

Advisory committee members also play an important role in serving as a conduit to connect to broader communities, constituencies, and colleagues, and helping the project team navigate community dynamics ([River Network & the Colorado Water Conservation Board 2024](#)). Advisory committee members can help identify others who should be informed of project updates, even if they are not actively participating on the advisory committee and attending meetings. This broader group of project supporters may also include those with technical expertise to assist with interpretation, people with data or information to include in the characterization, partners with educational or outreach networks to share the project, funders, and others ([US EPA 2008](#)). It may also include people in the community with an interest in watershed conditions. Broader community engagement is addressed in the Chapter 3 subsection [Gathering feedback and community engagement](#).

Decision-making and participation

There are many important decisions to make during the watershed characterization process, ranging from the focus of the project, to what specific information to include, to what colors to use on maps. Decisions can be made by a range of people, including the project manager, the project team more broadly, the advisory committee, a technical committee, a funder, or the entire group. They can be made by majority or by consensus. It is important to be clear who decides, who advises/makes recommendations, and where/how decisions will be made during

the watershed characterization process. For example, one approach could be that advisory committee members are consulted with key questions, and that input is used by the project team to make decisions. Decision-making by larger groups of participants, like the advisory committee, can require more time and process to reach a decision, but can also increase buy-in and ownership of the project ([US EPA 2008](#)).

River Network's [Decision-Making Models Worksheet](#) provides two different sample frameworks for how teams may consider various roles in decision-making (River Network 2025). For additional context on using these, see the Hudson River Watershed Alliance and River Network's [Organizational Health Self-Guided Learning Series - Episode 2: Leadership Models](#). It is important to maintain clear communication channels between everyone involved with the watershed characterization process.

Gathering feedback and community engagement

Watershed work should always be grounded in community. According to research conducted by the Center for Watershed Protection, watershed plans that bring decision-makers and community members at the very beginning of the process have the greatest chance of being successfully implemented ([US EPA 2008](#)). That includes participating in developing the watershed characterization.

The most focused feedback and engagement will occur within the context of the advisory committee, from the community voices that are represented there. Opportunities for the watershed characterization process to include more broad community feedback may include direct feedback on specific products, such as maps or the report narrative, or it can include more indirect feedback on questions, challenges, and priorities that watershed characterization or planning can help address.

For a watershed characterization process, valuable components of community feedback and engagement include understanding community interests, values, priorities, and needs to inform the content and structure of the watershed characterization process and product; sharing the project scope, process, and products transparently; and inviting the broader community to attend and participate in any parts of the project to provide direct or indirect feedback, such as a community presentation, opportunities to view maps, etc. Any relationship-building or community assessment that is done prior to starting the project, or through advisory committee representatives, will be helpful.

It can be challenging to know when the right time to engage broader communities in the watershed characterization process might be. It may not be a good use of limited volunteer time to ask for feedback too early in the process, and instead to have some materials drafted or finalized for people to respond to. The best order and timing for engagement will depend on the specific watershed, what kinds of existing relationships are in place, and the goals and scope of the watershed characterization project.

Compared to the watershed characterization process, the watershed planning process generally has more explicit roles for community engagement. For example, the workplan for NYS DOS-funded watershed plans includes setting a vision for the watershed before developing the watershed characterization, and then having a public meeting for feedback with both the vision and the completed watershed characterization (Table 2). These steps set the initial course of the project and provide a focus, further refine and build consensus on a shared vision with public feedback. Active community feedback is especially critical when priority implementation projects are discussed and selected, which is a central focus of the watershed planning process. Even still, the watershed characterization process benefits from engagement and feedback along the way, as discussed above. Watershed characterization products, especially maps, often provide a starting point for valuable community conversations. Community engagement may be an iterative process, and these conversations will likely continue over time to inform priorities and next steps.

Many watershed groups have opportunities to better understand community interests and engage feedback through their regular programming. This may include conversations while tabling at community events, discussions at watershed group presentations or events, short surveys in email newsletters, or more targeted 1:1 meetings. These all provide opportunities both to share information about the watershed and the characterization project, but also to listen. Having strong relationships in place with local, municipal, and regional partners is an important role for watershed groups, and will greatly benefit the project before, during, and after the watershed characterization.

Transparency to the broader community about the watershed characterization process and products should include who is involved, how the project is funded, and how decisions are made ([River Network & Colorado Water Conservation Board 2024](#), [Shilling et al. 2004](#)). It may be helpful to develop a communications or outreach plan to inform how this information is conveyed, such as a regularly updated public-facing project website ([River Network & Colorado Water Conservation Board 2024](#)). When the project is complete, in addition to posting the final watershed characterization products publicly online, it is helpful to revisit the project's intended outcomes to share the materials directly with specific key audiences. For more information, see the Chapter 6 subsection [Sharing your watershed's story](#).

For the pilot watershed characterization projects in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, the project team relied on advisory committee members to be liaisons for community interests and concerns. Both watersheds' local leads held leadership positions in their respective watershed groups, which provided a strong connection to watershed communities. Early in the process, following the project kick off meetings, the project team developed 1-page handouts with a project summary and watershed map for advisory committee members to share with their colleagues and constituents. These handouts were publicly posted on the Hudson River Watershed Alliance's website.

At the end of the process, the project team also held a community presentation in each watershed to share the project more publicly. These were held at the Town of Ancram Town Hall for the Punch Brook-Roeliff Jansen Kill watershed and St. Thomas Aquinas College for the Sparkill Creek watershed; both were held in the evenings to maximize participation and livestreamed/recorded for future reference (Figure 7, Figure 8).



Figure 7. Sparkill Creek Watershed Characterization Community Presentation at St. Thomas Aquinas College in Sparkill, NY on 3/25/24.

At each event, presentations included sharing the watershed characterization process and key findings from the reports, welcomes from municipal leaders, and updates from each local watershed group on how to get involved. Printed, large format copies of priority maps were displayed for public viewing. Attendees were also invited to share their feedback through a series of prompts on sticky notes, including their questions, concerns, what is exciting about the watershed, and ideas for next steps. The community presentations were very well attended, and generated valuable conversations. Copies of the presentation recordings and slides are available in [Appendix A: Watershed Characterization Templates](#).



Figure 8. Punch Brook-Roeliff Jansen Kill Watershed Characterization Community Presentation at Town of Ancram Town Hall on 4/15/24.

The Fishkill Creek watershed characterization maps were explicitly designed to generate community conversations and provide a starting point to receive feedback prior to collecting information for the watershed characterization report. To date, the Fishkill Creek Watershed Alliance has shared the initial maps with local residents, students, and staff as educational tools; with donors to encourage stewardship and engagement in watershed work; and with funders as part of grant applications ([Meierdiercks et al. 2025](#)). They have found that “the maps act like magnets during community events, drawing the public in and allowing an opening to engage with people” ([Meierdiercks et al. 2025](#)).

The maps will also be improved and refined as part of an upcoming watershed characterization process. Extending this process and breaking it into different steps also provides an additional opportunity to incorporate more local GIS data into the maps, and have them better reflect the information available and community priorities.

There are numerous resources available to support community assessment and engagement in planning processes, including:

- Hudson River Watershed Alliance & River Network (2026): [Organizational Growth Self-Paced Learning Series](#) video and handouts on [Community Assessment](#)
- River Network & the Colorado Water Conservation Board (2024): [“Watershed Planning 101” webinar](#) includes a framework for considering local interests, such as recreation/access, ecosystem health, regulatory compliance, infrastructure, etc. and a sample list of [Goals and Approaches for Stream Management Plans](#) to illustrate goals and motivations (River Network 2017)
- New York State Climate Smart Communities (2022): [Inclusive Community Engagement Primer](#)
- New York State Water Resources Institute (accessed 2026): [Inclusive Planning for Community Resilience: Equitable Engagement](#)
- US EPA (2010): [Getting in Step: A Guide for Conducting Watershed Outreach Campaigns](#)
- River Network (2023): [Inclusive Communications](#) guide

Funding for watershed characterization

Taken together, all of the information on project scoping will help develop the specific project goal(s) and scope of work, which in turn can inform the project’s budget. Watershed characterization project budgets could include funding for staff salaries; sub-contracts with consultants; honoraria for advisory committee members; travel to attend in-person meetings; printing agendas, handouts, or flyers; printing maps; other meeting materials; venue rental for meetings or presentations; hosting websites; designing and printing a watershed characterization report; etc.

Some work can be completed without or with very limited external funding. For example, there can be efficiencies in working with skilled volunteers and students (for more information, see [Appendix F: Resources to Engage Students in Watershed Characterization Projects](#)).

Larger projects will require funding, which often comes from grants. Any grant to develop a watershed plan will include the watershed characterization as a component. For more information, see the Chapter 2 subsection [What is a watershed plan?](#)

The watershed characterization is a discrete, required step in both 9 Element watershed plans and DOS watershed management plans that are funded by NYS DOS [Local Waterfront Revitalization Program](#) grants (for more information, see [Chapter 2: Watershed Planning Frameworks in New York State](#) and Table 1). NYS DOS [Local Waterfront Revitalization Program](#) grants can also fund a standalone watershed characterization as a “component,” if capacity issues or other constraints require the project team to complete a watershed plan incrementally. A standalone watershed characterization would not be eligible for NYS DOS Local Waterfront Revitalization Program grants funding for implementation, unless a subsequent NYS DOS grant funded the completion of the other required steps for a watershed plan.

The NYS DEC Hudson River Estuary Program’s Hudson River Estuary Grants for Local Stewardship Planning have specifically funded watershed characterizations. This grant program’s funding comes from [New York State's Environmental Protection Fund \(EPF\)](#). Eligible applicants include municipalities and non-profits located within the Estuary Watershed Boundaries. More information on grant programs and eligibility criteria is available on the Hudson River Estuary Program’s [Grants Program And Funding Opportunities For The Hudson River Estuary website](#).

Examples of watershed characterization projects funded by these Local Stewardship Planning grants include the Pocantico River Watershed Characterization (awarded in 2021), Black Creek Watershed Characterization (awarded in 2025), and Fishkill Creek Watershed Characterization (awarded in 2025), along with many other watershed-scale plans in past years (Table 4). Each of these three project proposals also included collecting new data to understand watershed conditions, in addition to developing the watershed characterization. Criteria for Hudson River Estuary Grants for Local Stewardship Planning depend on the year; please refer to the most recent information available on the Hudson River Estuary Program’s [Grants Program And Funding Opportunities For The Hudson River Estuary website](#).

Table 4. Hudson River Estuary Program Grant Awards: Local Stewardship Planning Grants for watershed characterization, 2021-2025. From [NYS DEC Hudson River Estuary Program 2025](#).

Year Applicant Award Amount		
2021	Pace University	\$46,612
The current state of the Pocantico River Watershed will be assessed through the compilation of existing information and the collection of new data. The assessment will characterize the current knowledge base of the watershed, identify gaps, document impairments, and provide recommendations for its conservation. In addition to a final assessment report , the data will be presented on an ESRI Story Map .		
2025	Town of Lloyd	\$75,000
This project will complete a Watershed Characterization and Water Quality Sampling for Black Creek. The watershed characterization will compile existing information about the watershed, describing its physical characteristics, lands, waters, and people. Themes will be illustrated by one or more maps and an accompanying summary, which will outline all relevant reports, plans, and data found, any information gaps identified, and a description of the watershed characteristics along that theme and their significance in the watershed. Sampling will be conducted throughout the three stream assessment segments designated by NYSDEC for Black Creek (lower, middle, and upper).		
2025	Clarkson University	\$75,000
Clarkson’s Beacon Institute will produce a Watershed Characterization for Fishkill Creek to support long-term watershed planning and stewardship. The Characterization will compile, synthesize and analyze existing and newly gathered watershed data, including: hydrology, water quality, ecology, biology, land use, aquatic connectivity, flooding, and habitats. The characterization will highlight management best practices and recommendations, and will inform production of user-friendly factsheets. Watershed management goals, attitudes, and concerns of stakeholder communities and public representatives will be reported and addressed.		

The Hudson River Valley Greenway provides financial assistance for local and regional planning projects in the Greenway Area through the McHenry Community Planning Grant Program. This can include a watershed characterization. These grants can build on each other, and set up opportunities for future funding to continue project work. Municipalities are the only eligible applicants, intermunicipal projects can receive higher awards, and the grants require a 1:1 match. More information is available on the Hudson River Valley Greenway's [McHenry Community Planning Grants website](#).

An example of a watershed characterization funded by the McHenry Community Planning Grant is the Town of Yorktown's [Watershed Inventory & Analysis](#) (Barton & Loguidice, D.P.C. 2025). This inventory was designed to provide an understanding of current watershed conditions and set up the Town for the NYS Department of State Local Waterfront Revitalization Program, which will develop recommended actions in the future ([Town of Yorktown 2025](#)). The project was funded by a \$15,000 Hudson River Valley Greenway Compact Grant; the contract was awarded in 2021, approved in 2022, and completed in 2025. According to the Hudson River Valley Greenway's [September 2025 newsletter](#):

“The Inventory provides a clear picture of local water resources, helping Yorktown prepare for future challenges such as flooding and harmful algal blooms while supporting recreational access and waterfront revitalization. It will also serve as a foundation for Yorktown's Local Waterfront Revitalization Program, ensuring long-term protection of natural resources and informed community growth. This project exemplifies the Greenway mission of balancing natural and cultural resource protection with sustainable economic development and regional planning.”

The Hudson River Watershed Alliance's watershed characterization 2022-2024 pilot project, working with the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, was funded by the Hudson River Estuary Program, New York State Department of Environmental Conservation, with support from the New York State Environmental Protection Fund, in cooperation with NEIWPCC. Available funding for the project was \$72,800, but actual project costs for the two watershed characterization reports came to \$98,150. Costs included Hudson River Watershed Alliance staff time and subcontracts, along with travel and meeting materials. We anticipate that future projects will take advantage of efficiencies and cost less than the pilot project.

Additional or different grants from New York State may be available to support watershed characterization in the future. For up-to-date information on New York State grants, use the [Funding Finder Tool](#).

Watershed characterizations can also be funded by private sources, such as foundations or individual donors. For example, the Fishkill Creek watershed characterization maps were funded by a generous donation from an anonymous individual. We encourage groups to think creatively about opportunities to secure the resources needed for the particular scale and goals of your project.

Key Points

Key points from Chapter 3: Watershed Characterization Process: Getting Started include:

- Before the process of compiling watershed characterization data even begins, it is important to clarify the purpose, scope, and audience for a watershed characterization. This includes understanding motivations (why), geography and scale (where), the content focus (what), and building the team (who). These will also inform the watershed characterization's structure and approach.
- A watershed characterization can focus on a number of different watershed conditions or issues. If the characterization is anticipatory or reactionary, it may focus on specific issues and information. If it is more exploratory, it may take a broader approach. The watershed characterization can also be scaled to the watershed, issues, or resources available.
- Outcomes of the watershed characterization process may include stronger relationships, increased public awareness, or increased watershed group self-efficacy. Multiple outcomes are possible and can be planned for. A watershed characterization publication can be cited, serve as a reference library, and be the foundation for future work.
- While selecting the watershed boundary for the characterization may seem straightforward, it is a significant step that often requires thoughtful consideration. Watershed boundaries can be delineated at a wide range of geographic scales or sizes, and through different processes. The size will impact the scope of the characterization, what data to include, and who will participate in the watershed characterization process.
- Watershed characterization products can take a range of different forms such as a detailed report, interactive website, or series of maps. These can be more polished products, or "working documents" that may be updated over time.
- The project team prepares materials for the watershed characterization process and product. Specific project team roles include a project manager to guide the process, a local lead to connect to and represent local priorities, and an advisory committee to provide feedback.
- While the most focused feedback and engagement occurs within the context of the advisory committee, there are also opportunities for the watershed characterization process to include broader community feedback and engagement.
- The project scope will inform the project's budget. Many grants are available to support watershed characterization, and some work can also be completed without or with very limited external funding.

Chapter 4: Watershed Characterization Process: What to Include

A watershed characterization compiles information about current watershed conditions, in a way that is most relevant to the project's goals. This chapter shares considerations for what information to include in a watershed characterization once the project is underway. It walks through recommended steps to collect, organize, and document relevant information, with a suggested outline for content and a process to gather both publicly-accessible and local sources of information. Each of these steps includes decision-making.

The amount of information that is available can be overwhelming. Having guidelines around what information to include established and understood by the project team and advisory committee will be helpful to limit project drift, especially to keep the project on time and budget, and to ensure that the process moves towards the project's priority objectives.

Watershed characterization report outline

Watershed characterizations that are exploratory or take a broad approach will generally include information about the watershed's physical characteristics, land, waters, and people. Projects that are anticipatory or reactionary may have a more specific focus. For more information on confirming the watershed characterization motivations and focus as part of project scoping, see the Chapter 3 subsections [Watershed motivation and goals](#) and [Watershed characterization focus](#).

Certain watershed planning frameworks, such as 9 Element watershed plans and NYS DOS watershed plans, require specific information to be included within that plan's watershed characterization. Following the guidance from this chapter would be supportive of a watershed characterization for either of these types of watershed plans. For more specific details about those frameworks' recommendations and requirements for the watershed characterization, see [Chapter 2: Watershed Planning Frameworks in New York State](#).

Both the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization reports were exploratory. The following outline of chapters set the reports' structure:

- Introduction - background information on the watershed characterization process and goals
- Physical Characteristics - the watershed delineation, regional context, and physical characteristics like geology and climate
- Lands of the Watershed - land use, land cover, forests, wetlands, terrestrial habitats, and the built environment, all of which influence the watershed in a variety of ways
- Waters of the Watershed - the waterbodies and watercourses within the watershed, including floodplains and riparian areas, aquatic habitats, water quality, and water infrastructure
- People of the Watershed - the people living in and caring for the watershed

The table of contents and report outline should reflect the project’s priorities, and sections should be ordered in a way that is locally relevant. The Punch Brook-Roeliff Jansen Kill and the Sparkill Creek watershed characterization reports differed in the order and type of individual sections within each of these chapters, depending on what information was available and the most logical sequencing. For example, as a rural watershed, the Punch Brook-Roeliff Jansen Kill watershed characterization report included a section on Agriculture in the “Lands” chapter, while the Sparkill Creek watershed characterization report included a section on Watershed and Land Use History in the “Lands” chapter. Drinking water was covered in the Aquifers & Water Use section for the Punch Brook-Roeliff Jansen Kill report (all drinking water came from private wells) and in the Water Infrastructure section for the Sparkill Creek report (mostly public water supply from a mix of sources). Copies of each report are available in [Appendix A: Watershed Characterization Templates](#).

Types of information

There are many different ways to know and understand a watershed. As a result, information compiled within a watershed characterization can take different forms. The *California Watershed Assessment Manual* encourages using quantitative measurements (numbers), qualitative information (descriptions), spatial data, anecdotal information, photographs, and other “facts” relevant to the watershed ([Shilling et al. 2004](#)).

For the watershed characterization pilot project, the project team defined types of information:

- GIS data: geospatial information stored in layers that integrate with geographic software programs and/or a spreadsheet of information that includes latitude/longitude or a street address.
- Dataset: a file that contains project-specific numeric records, such as a spreadsheet, table, or database.
- Report: a report out on a project or program that may be self-published.
- Plan: a specific type of report that collects information and considers future actions.
- Publication: information that is published via an outside source, such as a book, magazine, academic journal article, newspaper article, etc.
- Photograph: an image taken within the watershed that depicts specific environmental conditions (such as flood levels, Harmful Algal Blooms, extent of invasive species coverage, etc.)

The content of the information included within a watershed characterization will depend on the project’s goals and scope. Water quality monitoring results, municipal land use plans, biodiversity and habitat studies, and academic papers are just a few of the types of information that may be helpful to include.

While scientific studies and data are important to understanding a watershed, they don’t always tell the whole story. For example, academics might have access to data that shows water quality pollution or flooding, and local communities might have direct experiences of that pollution or

flooding. Community observations, experiences, and stories can provide rich and important detail to contextualize technical details. Some watershed characterization projects may want to incorporate or focus on oral histories, photographs, or stories collected from watershed residents.

Collecting and compiling information

It can be valuable to break down the watershed characterization information compilation process into phases, as different people can take on specific roles, and they can happen at different times in the project. Articulating which phases will be included in a watershed characterization can further break down the work into manageable components and roles, and can also help ensure that the team is on the same page.

The watershed characterization pilot project team identified three phases of the information compilation process:

- Phase I: compiling publicly-accessible federal, state, county, and regional datasets for maps and report narrative;
- Phase II: compiling reports, plans, and other information (often regional, municipal, academic, or local) to add to the report narrative and maps, where possible; and
- Phase III: interpreting the information to synthesize and tell the watershed's story. This may require specific expertise to explain what the information means and why it might be important.

The phases can be different milestones or stages within one watershed characterization project, or they could be the type of watershed characterization itself. They do not necessarily need to happen in numeric order, though the interpretation in Phase III will require some information to be compiled.

Phase I: Publicly-accessible datasets

Phase I includes compiling information from publicly accessible state, federal, and regional datasets and organizing that information into logical sections. This step is valuable for understanding what information might be available and to generate a more detailed table of contents or outline. It can also provide insight into what more detailed, local information might be important to find and cite.

A Phase I watershed characterization could also be a standalone product as a more streamlined version, or it could be a step on the way to a more detailed product. The NYS DEC Hudson River Estuary Program's Water Resources Summaries are a good example of a municipal-scale "Phase I"-type summary of watershed information. For example:

- [Town of Germantown Water Resources Summary](#) (2013)
- [Town of Chatham Water Resources Summary](#) (2012)
- [City of Hudson Water Resources Summary](#) (2016)

If budget, process, and timeline allow, it can be beneficial to start conversations with the advisory committee and/or public using the Phase I maps, gather local data, and then update the maps. This process can help locate additional local spatial data to add to maps, in addition to taking more time to understand local priorities to select which stories to tell through maps.

Phase I watershed characterization mapping is well-suited for an undergraduate student to take on, with support from a mentor/advisor and a local lead. Even with the relative simplicity of Phase I maps, it's important to have both technical experts and community members with local expertise to provide feedback ([Meierdiercks et al. 2025](#)). For more information on the project and recommendations on working with students, see [Appendix F: Resources to Engage Students in Watershed Characterization Projects](#). For more information about watershed characterization maps, see the Chapter 5 subsection [Maps and GIS](#).

The watershed characterization pilot project for the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds began with Phase I to set the table of contents and report structure. The project team especially focused on information available through the [Hudson Valley Natural Resource Mapper](#), the [DECinfo Locator](#), and the [NYS DEC Environmental Resource Mapper](#). Online mapping applications like these allow for interactive viewing of mapped features, attribute information, and links to more detailed information, without needing access to a GIS license. This process generated the Phase I draft watershed characterization report, which was reviewed by the advisory committees before the team delved more deeply into collecting additional, more localized information.

The pilot project mapping consultant, Green Goat Maps, also created the first set of maps by downloading publicly available GIS data. These maps included some municipal or local GIS data (such as MS4 outfall locations, community science water quality monitoring sites, and more detailed biological surveys), but primarily focused on federal, state, regional, and county GIS datasets, due to the project's timeline and process. For more information, see [Appendix C: GIS Data for Watershed Characterization Maps](#).

The Fishkill Creek watershed characterization mapping project focused specifically on developing a set of Phase I maps for the project team to initiate these kinds of conversations before beginning the full watershed characterization process. These maps will help build support for and inform the other steps of the characterization process, including forming an advisory committee, compiling additional information, and writing a characterization report. This process was designed to create iterative opportunities for community feedback on the maps at various stages in the characterization's development, and to allow for more time to locate and obtain local GIS data that were not publicly available for download ([Meierdiercks et al. 2025](#)). The maps will be refined with more local data and local feedback later in the process ([Meierdiercks et al. 2025](#)). Sample watershed characterization maps, including the Phase I Fishkill Creek watershed maps, are available in [Appendix B: Sample Watershed Characterization Maps and Layers](#).

Phase II: Reports and local information

Phase II involves compiling relevant information about current watershed conditions that is embedded inside reports, plans, publications, datasets, etc. These may be from regional, municipal, academic, or local sources. Having access to localized information can be especially relevant for local decision-making. Reviewing and compiling this disparate information into one location is often an important step of the watershed characterization process.

A local watershed group member or other local lead could be well-positioned to lead this work, especially if they have strong relationships already in place and know the right contacts to ask for information. Tracking down relevant information about the watershed is also an important role for advisory committee members to play, especially materials they may have access to through their own work, colleagues, or other contacts. There may be limitations on sharing certain types of information in certain formats, and having a sense of trust between partners can be helpful. Depending on the capacity and expertise of a specific project team, Phases I and II could be completed by a watershed group member or volunteer. For more information about roles and expertise, see the Chapter 3 subsection [Building the team](#).

[Appendix D: Information Checklist for Watershed Characterization Report](#) provides a sample list of the kind of information that might be helpful to look for as part of Phase II, based on what was included in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterizations. The information listed in Appendix D can be collected by someone who does not have access to GIS.

Phase III: Interpretation

Phase III of the watershed characterization process focuses on interpreting the information gathered in Phases I and II. This includes synthesizing information from different sources to tell the story about why it is significant. This phase may require specific subject matter expertise and is an opportunity to engage technical advisors on the advisory committee or project team.

Effective interpretation relies on understanding what questions the watershed characterization is designed to answer. These questions may arise as part of the project scoping, during the process of compiling information, or when summarizing and presenting the watershed characterization findings to the public. It can be valuable to invite questions from the advisory committee and the public throughout the process, as the collective understanding of watershed conditions improves and evolves. For more details, see the Chapter 5 subsection [Analyzing data and information](#). Effective interpretation also relies on what information is available; for more information, see the Chapter 5 subsection [Identifying data gaps](#).

The pilot watershed characterization projects for the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds did not include Phase III-level interpretation. This was primarily due to project timeline and budget limitations. These watershed characterizations leaned on interpretation

that was done within individual reports or assessments cited in the report, rather than cross-content synthesis.

Seeing this gap, the project team designed the characterization report to provide access to many different sources of information in an easy-to-use format, with links for more detail as needed. The goal was to support communities in interpreting information and deriving their own meaning locally after the watershed characterization process had ended.

Where to find information

Information relevant to the watershed characterization may be found in a wide range of places. [Appendix C: GIS Data for Watershed Characterization Maps](#) shares public sources of GIS data, including webmaps and specific GIS files. [Appendix D: Information Checklist for Watershed Characterization Report](#) includes possible state, federal, county, academic, and local sources of non-spatial data.

Information for Phase II of a watershed characterization may be located in a wide range of locations. Valuable files might be stored in the digital or physical archives of specific partners, such as watershed groups, local libraries, land trusts, local and regional nonprofits, consulting firms, academic institutions, county agencies, and state or federal agencies. Advisory committee members that can help connect the project team to this information, whether through their own files, organizations, or relationships with partners, are extremely valuable. Watershed groups may also want to develop and maintain a reference library of this information ahead of a watershed characterization process, which can save a significant amount of time and money once the process begins.

It can also be helpful to review reports from within the watershed that have already inventoried information. Natural Resource Inventories (NRIs) and other conservation plans in particular can quickly help orient the project team to available information, including relevant materials that they might not know about. These may be written for a municipal, county, or regional scale; regardless of the scale, if they inventory information within the watershed, they will likely be an important reference.

For example, the Punch Brook-Roeliff Jansen Kill watershed characterization drew heavily from the materials included and cited in the [Town of Ancram Natural Resources Conservation Plan](#) (2015) and the [Columbia County Natural Resource Inventory](#) (2018), both prepared by Hudsonia Ltd. In the Sparkill Creek watershed, the information compiled in the [Hudsonia Biodiversity Assessment Training: Rockland County Shoreline Group Draft Final Report](#) (2004) was extremely valuable; several co-authors of that report served on the watershed characterization Advisory Committee, providing institutional knowledge and a deep understanding of the watershed 20 years later. The [Bergen County Master Plan](#) (2023) was also very helpful in orienting the project team to relevant information and programs for the New Jersey portion of the Sparkill Creek watershed.

Some watershed characterization projects include collecting new data, in addition to organizing existing information. New data can provide a more timely update compared to a baseline, fill gaps in geographic/spatial understandings, or respond to a new set of questions with a new set of information. The watershed characterization pilot project in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds did not collect any new data, due to budget, timeline, and scope limitations. Funded watershed characterizations for the Pocantico River, Fishkill Creek, and Black Creek watersheds all do include collecting new data; for more information, see the Chapter 3 subsection [Funding for watershed characterization](#) and Table 4. Collecting new information or data can also be a follow up project, after the project team has a better sense of data gaps through the watershed characterization process.

Organizing and documenting information

It is important to create a system to track sources of information, where they are filed/located, and how they will be used within the context of the watershed characterization. All references should be carefully organized; this can be as simple as an annotated bibliography. The US EPA's *Handbook for Developing Watershed Plans* recommends using a spreadsheet or database to list all relevant information within a "data inventory" ([US EPA 2008](#)). Regardless of the approach, documenting this process is beneficial for transparency to the community, for future reference, and as part of grant reporting ([Shilling et al. 2004](#)). If one of the project goals is to create a reference library, the bibliography or data inventory will be an important product to easily access source materials in the future.

The watershed characterization pilot project for the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds was guided by a [Watershed Characterization Secondary Data Quality Assurance Project Plan \(QAPP\)](#). "Secondary data" refers to data that was collected by someone other than the person using it, as opposed to "primary data," which was collected by the researcher or user. A secondary data QAPP for the watershed characterization pilot project was required by NEIWPC, the project funder, as part of their quality assurance protocols ([NEIWPC 2019](#)).²

Developing a secondary data QAPP for the watershed characterization pilot project provided a formalized process to discuss and decide how to create a data inventory, what information to include, and how to know if data were of sufficient quality for this project. Once these decisions were made and confirmed through QAPP approval, the project team followed these processes to assure quality requirements were met. Process details are available in the [Watershed Characterization Secondary Data Quality Assurance Project Plan \(QAPP\)](#).

² Most watershed characterizations will not require a secondary data QAPP. A *secondary data* QAPP is not required for NYS DOS-funded watershed plans, either a 9 Element watershed plan or a DOS watershed plan; however, a *primary data* QAPP is required for NYS DEC-approved 9 Element watershed plan to address quality assurance for water quality monitoring. For more information, see the Chapter 2 subsection [Watershed characterization guidance from NYS DEC](#).

The watershed characterization pilot project team used one tracking spreadsheet to review GIS-based data used in maps and summary statistics, and a separate tracking spreadsheet to review other information used within the report narrative. These spreadsheets disclosed any limitations in data quality and identified if there were specific details available about data collection and methodology. The [Punch Brook-Roe Jan GIS Secondary Data Review Spreadsheet](#) tracked 49 data sources for the maps and GIS-based summary statistics and the [Punch Brook-Roe Jan Report Secondary Data Review Spreadsheet](#) tracked 60 data sources used within the report narrative. The [Sparkill Creek GIS Secondary Data Review Spreadsheet](#) tracked 66 data sources for the maps and GIS-based summary statistics and the [Sparkill Creek Report Secondary Data Review Spreadsheet](#) tracked 93 data sources used within the report narrative (Figure 9).

1	Data Title	Publication Date or Year	Author	Data Source (federal, state; regional, academic, county, municipal, local)	Data Type (report, publication, plan, dataset, GIS data, photograph, or other format)	Notes on data type (publication name, other format, etc. Are any other types included?) If relevant	Are there specific details about data collection and methodology? (yes, no, unsure)
2	Hydrology and Hydraulics Report for Existing Palisades Parkway Cul	2013	McLaren Engineering Gro	Municipal	Report	report prepared for Town of Ora	Yes
3	Preliminary Ecological Assessment of Sparkill Creek	1993	Hudsonia Ltd.	Regional	Report		Yes
4	River Herring Volunteer Monitoring Program 2008	2008	Larry Vail, Sparkill Creek	State	Dataset	NYS DEC community science p	Unsure
5	Hudson River Eel Project Summary Report 2008-2022	2022	NYSDEC Hudson River E	State	Report		Yes
6	Annual Drinking Water Quality Report for 2022	2023	Veolia	Regional	Report		Yes
7	Former Materials Research Corporation Supplemental Investigation:	2005	Leggette, Brashears, & G	Regional	Report		Yes
8	Water Resources of Rockland County, New York, 2005-07, with Emp	2010	Paul M. Heisig, USGS	Federal	Report		Yes
9	New Jersey Statewide Water Supply Plan	2024	NJ DEP	State	Plan		Yes
10	Resilience Roadmap: Planning for Piermont's Future	2014	Village of Piermont	Municipal	Plan		Yes
11	Water System Summary: Public Water Supply	2023	NYS Department of Health	State	Dataset		Yes
12	Groundwater Contour Map/VOCs in Groundwater	2022	Precision Environmental S	Regional	Report		Yes
13	Rockland Tomorrow: Rockland County Comprehensive Plan	2011	Rockland County Technica	County	Plan		Yes
14	Orangetown Comprehensive Plan	2023	Town of Orangetown	Municipal	Plan		Yes
15	Town of Orangetown Zoning Map	2018	Rockland County Planning	County	Other	Map	Yes
16	Recommendations for a Municipal Code Update for Water Quality, FI	2014	Marcy Denker Landscape	Regional	Report	Code Review	Yes
17	Village of Piermont Local Waterfront Revitalization Program	2018	Village of Piermont	Municipal	Plan	LWRP	Yes
18	2018 Master Plan: The Borough of Norwood, Bergen County, New Je	2018	Phillips Preiss Grygiel Let	Municipal	Plan		Yes
19	Borough of Alpine NJ Zoning Map	2011	Azzolina and Feury Engin	Municipal	Other	Map	Yes
20	Rockleigh Borough Zoning Map	2013	Neglia Engineering Assoc	Municipal	Other	Map	Yes
21	Borough of Northvale: 2020 Master Plan & Development Regulations	2020	Maser Consulting	Municipal	Plan		Yes

Figure 9. Screenshot of the [Sparkill Creek Report Secondary Data Review Spreadsheet](#), which tracked data sources used within the report narrative.

The materials developed for the watershed characterization pilot projects may be useful references for other projects, especially the [Information and Data Review Tracking Spreadsheet Template](#). The US EPA's [Checklist for the Assessment of Existing Information/Secondary Data](#) and other [Resources for Planning Projects that Use Existing Data](#) may also serve as helpful references for this process.

Depending on the watershed characterization's goals, the report narrative may include links or references to improve readability and provide background information, especially if the product is intended for a more public or non-technical audience. The pilot watershed characterization reports for the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds included many in-text links to websites to define terminology or provide context for data used in maps or charts, and listed these within the references section of the report. These references are distinct from the information specific to watershed conditions ("data" and "information") that would be organized within the data inventory, and also should be cited.

Evaluating information relevance

Once the process of compiling information begins, it can become challenging to keep track of the bounds of the project and what information is most relevant to the project's goals. The groundwork laid through the project scoping process will help answer questions related to what information to include in the watershed characterization. For more information on project scoping, see [Chapter 3: Watershed Characterization Process: Getting Started](#).

New information is always being developed, more information can always be found, and it can be hard to know when to stop. The US EPA's *Handbook for Developing Watershed Plans* warns that: "Data compilation can be an almost endless process; there's always something more to find out about your watershed... You'll want to be careful not to spend your budget on compiling data and information that you don't need—data that will not help you understand the watershed problems and meet your goals... Be careful not to collect existing information just because it's available" ([US EPA 2008](#)).

As part of the pilot watershed characterization project with the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, the project team developed a decision framework to evaluate if information that was available was relevant to the watershed characterization. The decision framework was part of the [Watershed Characterization Secondary Data Quality Assurance Project Plan \(QAPP\)](#) and each question was embedded into a column within the [Secondary Data Tracking Spreadsheets](#) to answer for each source.

The pilot project decision framework included:

- *Is this information from within the watershed?*
This may be a geographic area that is larger than the defined watershed, like a region or county; smaller than the watershed, like a municipality or a specific reach; or from the watershed as a whole.
- *Does it inform an understanding of current watershed conditions?*
In general, the most current available data was used, unless past data provided a valuable baseline or other context to understand current watershed conditions, such as trends and changes over time. This question can also confirm that the information is related to a specific content focus of the watershed characterization.
- *Are there specific details about data collection and methodology?*
If the information did not include details about data collection, methodology, or a publication date, but provided relevant, if limited, information, it could still be used with a disclaimer.
- *How will information be used in the watershed characterization?*
Depending on the form and relevance of the information, it was described in the report narrative, used in map(s), listed in tables or charts, or linked only for reference.

When deciding what information is most important to locate and include, it is important to stay focused on the project's central questions and objectives.

Additional prompts may include:

- To what extent does an understanding of these current watershed conditions contribute to watershed management decision-making?
- Is this information critical for next steps at this time?
- Is finding or learning this information a priority next step after the characterization process, or is it lower priority based on what we currently know, value, or can manage in this watershed?

Depending on the relevance to the project's goals, information may be used in different ways. Some materials that are highly relevant might be described or assessed in more detail in the report narrative. Other materials might be referenced/cited in the report narrative, or organized into a separate reference library for future access.

Considering data quality

Data quality should be considered for any information that is included within the watershed characterization. Specific details about data collection and methods will help put the information into context to understand how accurate or reliable it might be ([Shilling et al. 2004](#)). This can include whether the information was collected with its own quality assurance protocols, if it included a process of peer or external review, and if the methods are sound or established ([Shilling et al. 2004](#)).

To comply with the watershed characterization pilot project's [Watershed Characterization Secondary Data Quality Assurance Project Plan \(QAPP\)](#), every source of data or information was reviewed for specific details about data collection, methodology, sources/citations, and publication date. If the information did not include details about data collection, methodology, or a publication date, but still provided relevant information, it was used with a disclaimer.

The watershed characterization pilot project reports also included general disclaimer language about data quality within the introduction chapters. This included that the information contained could have inaccuracies and/or could change in important ways in the future, was limited to what was available at the time of publication, was not intended to be used for site-level planning, was not a substitute for on-the-ground surveys or direct knowledge, should be verified for legal purposes, and it was not intended for jurisdictional or regulatory purposes. For more details, see copies of each report in [Appendix A: Watershed Characterization Templates](#).

While state and federal datasets are more likely to use standard methods or quality assurance protocols, mistakes can still happen. These datasets often cover a large extent with a lot of detail, and errors may be more obvious on a local watershed scale. This can include spelling, location, or information errors. Local knowledge is invaluable for detecting these errors, which is an important role for the advisory committee in reviewing watershed characterization products. Any data errors that are found should be acknowledged in the watershed

characterization. Data corrections could also be made, depending on the circumstances. If local edits are made to update federal or state GIS layers, it is critical to document those changes with a digital “paper trail” for future reference or use (Alex Wolf, personal communication, February 1, 2024).

For example, within the Punch Brook-Roeliff Jansen Kill watershed, the [New York State Museum’s Bedrock Geology GIS layer](#) misidentified a large section of limestone bedrock as water. This error had been corrected in [Columbia County’s Bedrock Geology GIS layer](#), which was used for the watershed characterization map. An Advisory Committee member also flagged that while the NYS DEC’s [2022 CSLAP](#) (Citizens Statewide Lake Assessment Program) report for Upper Rhoda Pond in the Town of Copake indicated that no invasives are present, this was not correct; in 2023, the Upper Rhoda Lake Association [applied to NYS DEC for a permit](#) to remove invasive aquatic plants. This was acknowledged in a footnote within the report.

Key Points

Key points from Chapter 4: Watershed Characterization Process: What to Include:

- Once a watershed characterization project is underway, the process of compiling, collecting, and sharing information involves active decision-making. Types of information can include GIS data, datasets, reports, plans, publications, photographs, anecdotal information, and other “facts” relevant to the waters.
- The process to compile information can be broken down into distinct phases. Phase I is compiling publicly-accessible federal, state, county, and regional datasets for maps and report narrative; Phase II is compiling reports, plans, and other information (often regional, municipal, academic, or local) to add to the report narrative and maps; and Phase III is interpreting the information to synthesize and tell the watershed’s story.
- Relevant information may be found in a wide range of places. Spatial or GIS data and webmaps are often publicly available. Other information is available through state, federal, county, academic, and local sources. Reviewing existing reports from within the watershed that have already inventoried information can provide a helpful starting point. Some watershed characterization projects may include collecting new data.
- Once the process of compiling information begins, it can become challenging to keep track of the bounds of the project and what information is most relevant to the project’s goals. A decision framework can help evaluate whether available information is relevant to the project’s objectives.
- It’s important to create a system to track sources of information, where they are filed or located, and how they will be used within the context of the watershed characterization and its products. Data quality should be considered and documented for any information that is included within the watershed characterization.

Chapter 5: Watershed Characterization Products

The products of a watershed characterization can take a variety of different forms, depending on the project's goals and scope. These can include a PDF report, interactive websites or webmaps, a series of map images, or other forms. For more information on the forms that a watershed characterization may take, see the Chapter 3 subsection [Watershed characterization products](#). Regardless of the form, most watershed characterizations will include maps, tables, and a written narrative.

Watershed characterization products should be thoughtfully designed and inclusive of community priorities. The materials should not only effectively represent and communicate current watershed conditions, but they should also reflect community values, effectively connect people to their watersheds, and inspire action ([Meierdiercks et al. 2025](#)).

This chapter focuses on considerations when creating maps, calculating summary statistics, and writing a narrative for a report. It also includes a discussion of data gaps, interpretation, and analysis that can help contextualize current watershed conditions to set up decision-making and other next steps. While not every watershed characterization may include all components, and maps or narratives may take different forms, this guidance is broadly applicable for watershed characterizations of different scopes.

Maps and GIS

Maps represent a very important tool for understanding and illustrating current watershed conditions. By bringing different layers and themes of information together, they can help generate new insights and stories ([Meierdiercks et al. 2025](#)). Maps share geospatial data from the watershed, and are often either a static image file or an interactive webmap. There are many ways to create maps, but most watershed characterization maps are generated using Geographic Information Systems (GIS), a tool for viewing and analyzing geospatial information.

Creating maps requires a significant amount of decision-making. Cartography, the art and science of making maps to communicate spatial information, and other design decisions by the project team will inform watershed characterization maps' forms and functions. This includes their form, geographic extent/resolution, what information is displayed in a map (as opposed to within a table or in the report narrative), how that information is broken down thematically, color choices, and symbols used. What can seem like small or insignificant decisions can have a big impact on how people perceive and use the map.

Map image files can illustrate key information or themes in the watershed characterization. These may be embedded within a watershed characterization report, serve as a standalone series, and/or be printed and displayed. Organizing information around priority stories, and using maps as illustrations within the context of the project, can help users understand information fairly quickly and simply.

For help with cartography-based decision-making, particularly accessible design principles and considerations for map images, see Green Goat Maps's [Guide to Accessible Map and Kiosk Design](#) (Green Goat Maps 2024). Green Goat Maps staff led cartography as part of the watershed characterization pilot project team and included a copy of the Punch Brook-Roeliff Jansen Kill Watershed Characterization wayfinding map in this guide.

Interactive webmaps are valuable tools and are increasingly popular, but it is important to recognize the steps needed for information to be interpreted. In addition to the project team's decision-making to develop a webmap, these tools often also rely on individual decision-making by webmap users. This can include zooming in to different extents, selecting different available layers, etc. to derive meaning. This may be a fairly straightforward process for environmental professionals who are familiar with the details of certain datasets and have some GIS experience, but watershed groups and volunteers may need additional support to work with or interpret the key themes of webmaps ([Meierdiercks et al. 2025](#)). Unlike maps that are PDFs or image files, webmaps often require maintenance or updates over time, which can cost time and money.

Regardless of the form, cartography-based decision-making by the project team must be made in cooperation with map users and other members of the community. While creating GIS-based maps requires technical skills, effective maps also require community feedback. It takes local knowledge and broader community input to create maps that accurately reflect and communicate local conditions ([Meierdiercks et al. 2025](#)). Templates are valuable starting points, but each map should be customized based on local understanding of a place to depict and communicate local issues ([Meierdiercks et al. 2025](#)).

For more details and an excellent case study on equitable co-production between technical GIS experts and community members, see:

- The academic journal article: "[The Tar Creek Superfund and Flood Map: A Case Study in the Equitable Co-Production of Maps for Storytelling, Environmental Activism, and Education](#)" by Lively et al. (2026) and
- The Hudson River Watershed Alliance webinar recording: "[Can academic-community partnerships be equitable? A case study of the Tar Creek Superfund Flood Map](#)" by Katherine Meierdiercks, Siena University (2024).

For the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization reports, the project team chose to create map images as illustrations, rather than webmaps. In addition to being embedded within the watershed characterization report, the map files were shared in a Google Drive folder (as PDF and PNG files), printed to display at each project's community presentations, and provided to the watershed groups for future use after the watershed characterization projects were completed. Image files of the maps enabled the project to be shared more broadly during and after the watershed characterization process. The maps generated valuable conversations at the community presentations, and will continue to be used by the watershed groups to display publicly and at community events.

Each watershed’s advisory committee reviewed the map series and provided valuable feedback to incorporate into map revisions. The project team found feedback particularly helpful for the wayfinding maps, which help to orient people to specific landmarks within their communities to understand where the watershed boundary is located and interpret the various maps’ themes (Figure 10). The project team solicited advice on map extent, which roads to include or highlight, local landmarks to label, and other details to make the rest of the watershed characterization maps as easily understandable by local audiences as possible.

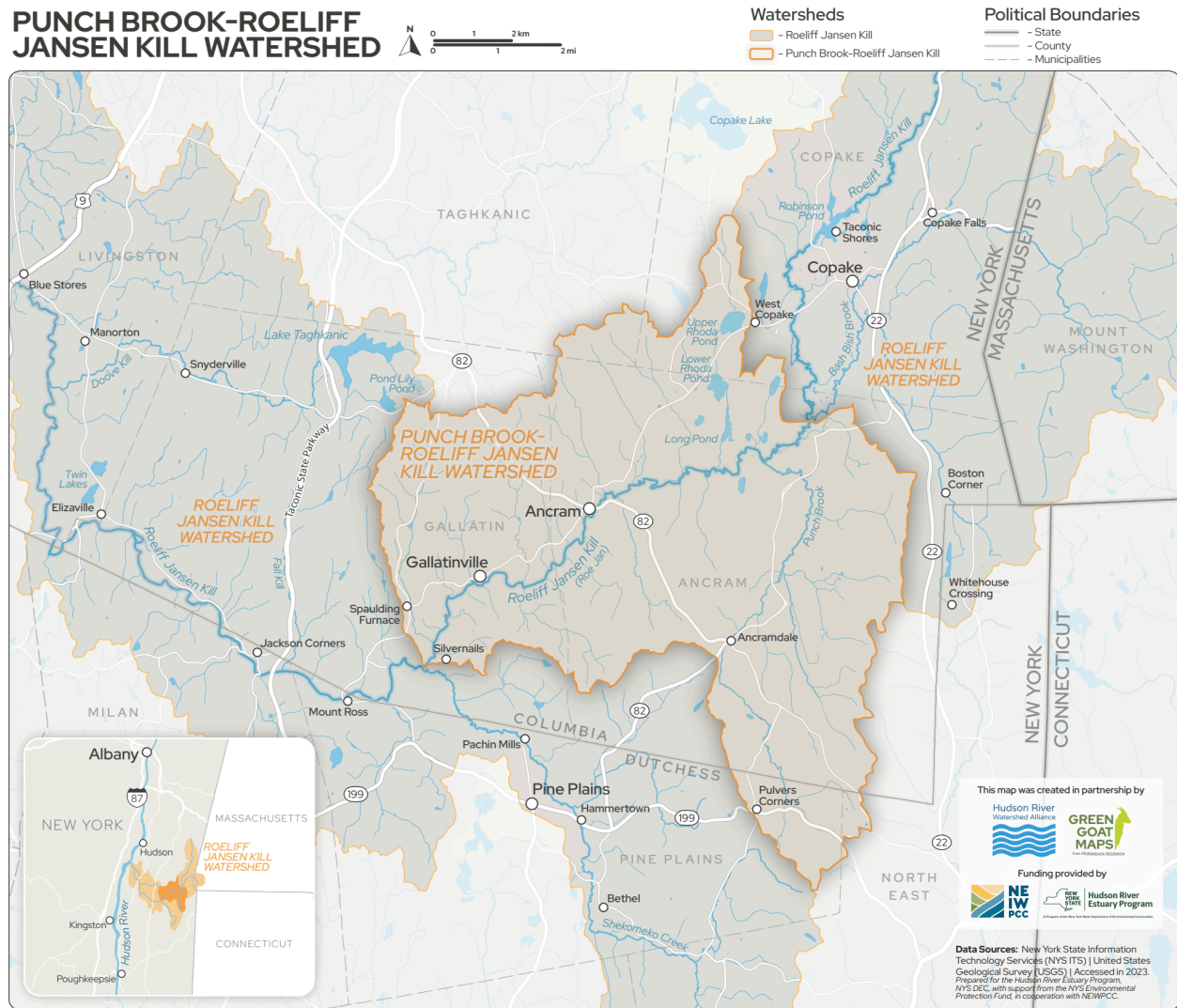


Figure 10. Punch Brook-Roeliff Jansen Kill Watershed wayfinding map, which included municipalities, political boundaries, hamlets, roads, waterbody names, and the watershed context to orient people to the geographic area of focus.

For the Fishkill Creek watershed maps, similar feedback was provided by project team members rather than an advisory committee. Details on the Fishkill Creek watershed characterization

mapping project process are available in the paper “[Watershed Characterization to Enhance Student Learning and Build Capacity for Community-Led Watershed Planning and Management](#)” by Meierdiercks et al. (2025).

Copies of watershed characterization maps for the Punch Brook-Roeliff Jansen Kill, Sparkill Creek and Fishkill Creek watersheds are available in [Appendix B: Sample Watershed Characterization Maps and Layers](#). Databases and sources of GIS data used for all three watersheds’ maps are available in [Appendix C: GIS Data for Watershed Characterization Maps](#), along with a checklist of the specific GIS layers used for each map.

Summary statistics

Summary statistics are numbers or values that describe and simplify larger datasets. For watershed characterizations, summary statistics are often generated through GIS to describe and summarize spatial data across the watershed. For example, percentages of different land use and land cover categories, the number of road-stream crossings by type, or total stream length within a watershed would all be considered summary statistics.

Many summary statistics can be computed for a watershed using free and accessible web tools such as the [US Geological Survey's StreamStats](#) and the Stroud Water Resource Center's [WikiWatershed Model My Watershed tool](#). Other summary statistics may require intermediate-to-advanced geospatial analysis skills, and should be computed in consultation with a GIS expert.

Table 4. Examples of summary statistics computed in GIS for the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization reports. From [Meierdiercks 2025](#).

Watershed physical characteristics:

- Percentage of each municipality in the watershed.
- Area of watershed and each subwatershed
- Minimum and maximum elevation in watershed
- Percent of each soil type in the watershed
- Percent of each soil drainage class

Lands of the watershed:

- Percent of each land use in the watershed
- Percent of watershed covered by forest
- Number and total area of each wetland type in the watershed
- Percentage of farmland soils in the watershed

Waters of the watershed:

- Number of road-stream crossings by type, and culvert passability score, in the watershed
- Stream classification: number of segments, total stream length, percent of each classification (based on length) for each classification type
- Lake/Pond classification: number of waterbodies, total waterbody size, percent of each classification (based on size) for each classification type

For the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization projects, map cartography and design was led by Green Goat Maps and calculating summary statistics was led by Katherine Meierdiercks from Siena University. Summary statistics were displayed in tables within each report's narrative. A list of summary statistics that were computed for the pilot watershed characterization projects is available in Table 4.

Report narrative

The report narrative provides a space to communicate, in a logical order, the information that has been compiled and to develop a shared understanding of the watershed. In addition to presenting the compiled information, the report narrative can include interpretation, analysis, and data visualization. The narrative may include text, tables, images, maps, or other helpful tools to share information. It may also link to additional tools, resources, or references. Regardless of how this information is presented, it is important to consider how the information contributes to telling the broader story of watershed conditions.

This section is most relevant for a more traditional watershed characterization that includes a written summary report; not every watershed characterization will include a report narrative. For more information on the different forms that watershed characterizations can take, see the Chapter 3 subsection [Watershed characterization products](#).

To help the report narrative tell the story of the watershed, there should be careful consideration of how information within the report is organized into themes, how priority information is shared, and how that information can be meaningful for the people who care about the watershed. This shares existing understandings of the watershed, along with opening opportunities to create new understandings with new perspectives or information over time.

Depending on the audience and purpose, the narrative language may be more technical or more public-facing. The narrative should provide enough background information for the project's intended audience to clearly understand key messages. The specific type of audience and purpose will inform what kinds of background information is included or linked to provide context; this could include explanations of terminology, scientific processes, state programs, regulatory frameworks, etc. For more details on specific audiences or outcomes, see the Chapter 3 subsection [Intended outcomes of the watershed characterization process](#).

For example, the watershed characterization pilot projects for the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds included a significant amount of information about the built environment and key terminology that may not be familiar to audiences that have a natural resources planning background. Those reports included many links to relevant NYS DEC programs and written paragraphs defining key terminology related to solid waste facilities, hazardous substance bulk storage facilities, remediation sites, and permitted and reclaimed mines.

It is always important to have checkpoints in the process for the advisory committee, local representatives, and/or technical partners to review the draft narrative and provide feedback. This can help flag any errors, find information that isn't yet included, and keep the project centered in community priorities.

For the pilot project in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, the advisory committees reviewed the Phase I draft report narrative (with publicly-accessible federal, state, and regional data), the draft maps, and the complete Phase II watershed characterization report narrative (with many additional state, regional, academic, municipal and local sources of information). Project funders at the NYS DEC Hudson River Estuary Program and NEIWPCC also reviewed the Phase I and complete Phase II draft narratives, along with the draft maps, to provide technical feedback before finalizing the watershed characterization reports.

Analyzing data and information

But what does all this information mean? The watershed characterization report narrative will include some amount of interpretation to share the meaning and local significance of the maps, summary statistics, and other data. The nature and depth of this interpretation within the watershed characterization can vary depending on the project teams' expertise, available time/budget, and scope of the project.

There are many different ways to interpret watershed data and find meaning in watershed information. Understanding and communicating meaning may require different perspectives, expertise, or experience. A spreadsheet of data or numeric values for a particular water quality parameter does not on its own have any meaning; there must be some interpretation of those data to help readers make meaning from them and place them within the context of the watershed. *The California Watershed Assessment Manual* acknowledges that this step is often missing, and warns that: "You might be data rich, but information poor, and find yourself staring at a bunch of numbers that do not yet tell a story" ([Shilling et al. 2004](#)).

Improving watershed health is frequently cited as a primary goal of watershed management and planning work; however, this can be surprisingly hard to measure, as watershed health is both broad and subjective ([Shilling et al. 2004](#)). Telling a story requires clear and specific benchmarks. For example, while numeric water quality data alone are not very helpful, comparing specific data and information against established standards or indices can unpack different meanings of "watershed health," especially when focused on the issues or challenges that motivated the watershed characterization process ([Shilling et al. 2004](#)).

There are many possible indicators of watershed health, including those related to water quality, hydrology and streamflow, riparian areas, in-stream or terrestrial habitat, and more ([Shilling et al. 2004](#)). Documented indicators and standards can also provide a baseline to understand trends over time, whether specific datasets have been collected more recently or an existing watershed characterization is being updated.

Indicators, standards, or benchmarks can be used in different contexts to derive different types of meaning from watershed characterization information. These may include regulatory, scientific, community, and regional perspectives. These contexts can also represent different pathways for using information in storytelling, decision-making, or developing strategies as next steps.

For a regulatory or policy perspective, NYS DEC has [water quality standards](#) that provide thresholds for understanding water quality impairments. These include numeric standards, narrative standards, and numeric guidance values for parameters that do not have established standards. Some benchmarks are built into how NYS DEC presents data, and these can be helpful for interpretation. For example, [macroinvertebrate sampling \(“biomonitoring”\)](#) results use a Biological Assessment Profile (BAP) score that ranges from zero (“severely impacted”) to ten (“non-impacted”).

It may not be appropriate to compare data to NYS DEC standards if the data have not been collected according to the Division of Water’s quality assurance protocols. However, these standards can still provide useful benchmarks to understand water quality indicators. Other agencies such as US EPA, NYS DOH, etc. may also have water quality standards that can provide useful references. Regulatory standards may not be available for all water quality parameters.

Scientific research and literature may also have baselines, indices, or norms for particular watershed indicators. These may be especially helpful to use if specific regulatory standards are not available, and to provide context for understanding findings. For example, the meaning of water quality data could vary depending on the sampling time of day, if there are wet or dry conditions, or based on specific methodologies.

Watershed communities may also be able to articulate meaningful benchmarks. In the specific watershed or location, it is important to understand what information means to the people that live, work, and play there. Residents’ and local partners’ observations can provide significant community context to help explain data; for example, experiences of poor water quality or flooding, possible local sources of pollution, or impacts that might not be obvious from data alone. Photographs and stories can provide local context about sites and conditions.

Beyond the specific watershed of focus, it may also be valuable to evaluate regional context. Understanding how the focus stream or watershed compares to others in the region where information is available can provide a meaningful benchmark. For example, Riverkeeper and their partners collect data on *Enterococcus*, a US EPA-approved fecal indicator bacteria, in rivers and streams across the Hudson Valley. In the watershed characterization pilot project, the project team compared fecal indicator bacteria data from the pilot watersheds to Riverkeeper’s data from other watersheds. This comparison showed that the Roeliff Jansen Kill (including the portion within the Punch Brook-Roeliff Jansen Kill watershed) has some of the lowest levels of this indicator bacteria compared to other watersheds, while the Sparkill Creek has some of the highest levels detected in the region.

Some datasets come with clearer built-in interpretation that has already been provided by the people who collected the information. It can be helpful when data have already been interpreted in another report or publication, and that report or publication can be cited in the watershed characterization report.

Having information come with interpretation or benchmarks was extremely valuable for watershed characterization pilot projects in the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watersheds, as it made understanding and sharing the information much faster and easier. Some examples included [Significant Natural Communities](#) for aquatic and terrestrial habitats mapped by the New York Natural Heritage Program; [Waterbody Inventory/Priority Waterbodies List](#) assessments conducted by NYS DEC; [Biological Assessment Profile \(BAP\) scores](#) from NYS DEC “biomonitoring” of macroinvertebrates; and households under financial stress based on the [Asset Limited, Income Constrained, Employed \(ALICE\) rate](#) evaluated by the national United For ALICE organization. Though very valuable, the number of resources with built-in interpretation may be limited. A surprising finding of the watershed characterization pilot project was how little interpretation and analysis of relevant datasets existed.

Uncertainty around the analysis and interpretation of watershed data should be acknowledged, discussed, and documented within the watershed characterization process. Managing uncertainty is a reality for any environmental monitoring work. It can be challenging to know when enough data has been collected to draw conclusions and answer questions ([Shilling et al. 2004](#)). Considerations include the frequency of data collection, geographic extent, methods, volunteer vs. professional sampling, the accuracy or precision of results, etc. ([Shilling et al. 2004](#)). This holds true both in understanding the findings of a specific study, but also in analyzing available studies across the watershed for a watershed assessment. Data may also be contradictory across different studies, which could be related to different methods, timeframes, errors, or uncertainty ([Shilling et al. 2004](#)). Other important factors that can contribute to the complexity of data analysis are professional understanding and acceptance versus social understanding and acceptance ([Shilling et al. 2004](#)).

There may be times when additional interpretation is needed, but the data and information are too complex for the time, resources, or scope of the current watershed characterization process. More detailed, specific, or synthesized interpretation may also be a priority next step after a watershed characterization project is complete.

Data visualization

Data visualization shares relevant information through graphics; in addition to maps, this can include charts, graphs, illustrations, diagrams, and more. Good visuals can communicate trends, compare data, and can also help with quality assurance/quality control by showing outliers that might be harder to see in a spreadsheet or database ([River Network & Princeton Hydro 2022](#)).

As with all science communication, it is important to identify the specific audience and what background information they would need to know in order to understand what is being presented ([River Network & Resource Media 2020](#)). Depending on the audience and project goals, there are a variety of forms of and approaches to data visualizations; for example, focusing on a specific pollutant across the watershed, looking at a variety of parameters at one particular location, using a “scorecard” or “report card” approach to consolidating information against benchmarks, or creating a “data explorer” tool to help users ask and answer their own questions ([River Network 2020](#)).

Visuals can be embedded as images within the watershed characterization report, or they can be separate products that are linked or otherwise live outside of the narrative. This can be especially helpful if the data informing the visualization are updated more frequently than the watershed characterization. For example, a webmap may be updated monthly with new water quality monitoring results, or an online graph may show real-time data from in-stream sensors. These online resources can be linked within a watershed characterization to provide access to the latest information, while still helping audiences find, interpret, and understand the information within the watershed characterization context.

River Network has many resources available to support effective data visualization and storytelling, including:

- [Data visualization webpage](#)
 - [Guide to Data Visualization Tools for Water Quality Monitoring](#) (2022) by River Network & Princeton Hydro
 - [Data Visualization Tips and Tricks webpage](#)
- [Data to Action webpage](#)
- [Collaborative Partnerships webpage](#), with resources for creating a partnership or memorandum of agreement (MOA), especially research partnerships with universities:
- [Data Visualization Tools webinar](#) (2020)
- [Data-Informed Storytelling webinar](#) (2020), presented by Resource Media, with River Network, the Academy of Natural Sciences, and Stroud Water Research Center.
- [Communicating and Visualizing Water Quality Data webinar](#) (2020), presented by Princeton Hydro, with River Network.

Watershed assessment

In the context of watershed planning, a detailed or in-depth interpretation of watershed information and data analysis is sometimes called a “watershed assessment,” to distinguish it from the “inventory” stage of compiled information and data ([Shilling et al. 2004](#), [NEIWPCC & Colorado Department of Public Health and Environment 2025](#)). Watershed assessments may include a discussion of emerging issues and threats, sources of pollutants, data gaps, considerations for future conditions or stressors, and a documentation of lessons learned through the watershed characterization and assessment process ([NEIWPCC & Colorado Department of Public Health and Environment 2025](#)).

Depending on the project scope, a “watershed assessment” can be included within specific watershed characterization chapters, its own chapter in the watershed characterization report, a standalone document, or a separate follow up project after all of the information has been compiled in the watershed characterization. This process is most powerful when information is synthesized or integrated across different sources of information to provide a more complete story that supports decision-making ([Shilling et al. 2004](#)). This step may require specific expertise on the project team.

The [California Watershed Assessment Manual \(2004\)](#) provides detailed recommendations for the watershed assessment process, which provides the basis for developing the science-based strategies and actions identified within a watershed plan ([Shilling et al. 2004](#)). The US EPA’s 2008 *Handbook for Developing Watershed Plans* shares guidance within [Chapter 7: Analyze Data to Characterize the Watershed and Pollutant Sources](#), and recommends including visual assessments, local knowledge, and anecdotal information to contextualize data ([US EPA 2008](#)).

The watershed assessment process can help bridge the gap between watershed characterization and planning. If preparing for a water quality-focused watershed plan, the watershed assessment should identify pollutant sources and causes of water quality impairments, to identify actions that reduce pollution or protect healthy waters ([US EPA 2008](#)). The US EPA’s *Handbook for Developing Watershed Plans* (2008) includes a table summarizing common pollutants and sources on page 10 of [Chapter 2: Overview of Watershed Planning Process](#). Analysis should focus on the priority questions, motivations, and concerns identified during the project scoping process ([Shilling et al. 2004](#)). Watershed assessments may also include strategies and action to address pollution threats or other watershed issues.

Identifying data gaps

Watersheds are extremely complex, and there will always be more data or information that could be collected. Having “complete” information is not a prerequisite for creating a watershed characterization. In many cases, relevant data or information will be missing. The watershed characterization process is designed to help identify these types of gaps. It will be easier to prioritize future studies to have a more complete picture, especially to influence management decisions, once the existing information is compiled and laid out.

Watersheds include different jurisdictions, and the same information may not be available across the whole watershed area. Some areas may have more data mapped or more detailed studies. It is valuable to share available information related to current watershed conditions, even if it is not standardized across the geographic area of focus. When that is the case, a disclaimer can explain where information is not available, so that it is clear. For example, some, but not all, municipalities may have completed culvert assessments within the watershed; it is valuable to share available culvert assessments, along with where data are not currently available. Collecting missing information can be a specific project as a next step, especially if it is a priority to understand conditions related to management decisions.

For additional guidance on identifying data gaps, see the US EPA's 2008 *Handbook for Developing Watershed Plans*, which provides specific guidance on this step within [Chapter 6: Identify Data Gaps and Collect Additional Data If Needed](#). The process in this chapter can help identify what information might be missing that currently exists, and what information might be missing that might need to be collected in the future.

The [California Watershed Assessment Manual \(2004\)](#) makes an important distinction between data gaps and knowledge gaps. Data gaps occur when information needs to be collected; knowledge gaps occur when the data exist, but it is unclear what it means within the watershed system ([Shilling et al. 2004](#)). A list of data gaps can also include a list of knowledge gaps, to ensure that interpretation and analysis are included to make meaning from that information so it can be as useful as possible for next steps and decision-making. Specific expertise might be needed, both for data collection and for interpretation to address identified knowledge gaps.

Key Points

Key points from Chapter 5: Watershed Characterization Products:

- Most watershed characterizations will include maps, tables, and a written narrative.
- Maps bring together different layers and themes of information, and are important for understanding and illustrating current watershed conditions. Maps require a significant amount of decision-making and community feedback to ensure they are useful.
- Summary statistics, often created using GIS, are numbers or values that describe and simplify larger datasets across the watershed.
- The written report narrative draws meaning from and shares information that has been compiled for the watershed characterization. The narrative may include interpretation of relevant information, along with visualizations.
- To be meaningful, available information and specific indicators of watershed health should be compared against benchmarks. Indicators or standards can be considered within various contexts to derive meaning, including regulatory, scientific, community, and regional perspectives.
- A watershed assessment is an in-depth interpretation of watershed information that addresses, for example, emerging issues and threats, or sources of and causes pollutants. This term is often used in the context of bridging from a watershed characterization to a watershed plan.
- The watershed characterization process can help identify data gaps that could be addressed as part of future studies.

Chapter 6: Using a Watershed Characterization for Next Steps

This chapter focuses on actions using the watershed characterization report or other products, once the process is complete. Some specific next steps include sharing the watershed characterization, identifying specific and targeted project opportunities, and using the watershed characterization as the foundation to develop a complete watershed plan.

It may be helpful to revisit the project's initial set of intended outcomes and goals, referenced in the Chapter 3 subsection [Intended outcomes of the watershed characterization process](#), to understand both intended opportunities for next steps and what new project priorities may have emerged through the process. Additional considerations are included in the Chapter 1 subsection [Benefits of watershed characterization](#).

The self-assessment worksheets developed by Karen Strong of Strong Outcomes, LLC for the Hudson River Watershed Alliance can help individuals and local groups think through next steps. In particular, [Worksheet 3: Reflecting on a Project in Process and Preparing to Implement](#) is designed for individuals and groups that are working on or have completed watershed characterizations to reflect on the planning process and identify key actions to strengthen outcomes and advance their work. For more information on the worksheets, see [Appendix E: Worksheets to Identify Watershed Characterization/Planning Next Steps](#).

Sharing your watershed's story

The watershed characterization brings together information to tell a specific watershed's story. Sharing that story will rely on bringing the watershed characterization and its materials or messages to specific audiences. This is a role that can be well-suited for watershed groups, along with other project team members.

After the watershed characterization is complete, it is helpful to revisit what audiences should hear about the project findings, and for what purpose. The highest priority audiences and users of the watershed characterization should have been identified during the project scoping phase (see Chapter 3 subsection [Intended outcomes of the watershed characterization process](#).) New ideas for audiences may have also emerged through the characterization process.

Potential audiences may include watershed group members, municipal officials (including elected officials, planning board members, Conservation Advisory Committees, Climate Smart Task Forces, etc.), community organizations, land trusts, county agencies, regional partners, watershed residents, specific landowners, and more. The information within the watershed characterization can provide valuable background and a shared understanding of conditions for municipal planning, land conservation, project selection/implementation, and other decision-making. It can also confirm a shared understanding of current watershed conditions and challenges, which can be helpful in generating support for next steps.

Opportunities to communicate the project and key findings with specific audiences can include briefing presentations, discussions at meetings, 1:1 conversations, or targeted communications to share copies of the materials and project context. Sharing the watershed characterization can also generate feedback and additional ideas for next steps, especially those that are in line with community priorities and interests.

The watershed characterization can be a valuable resource to guide the work of a watershed group. It can be shared with new watershed group members, leaders, or partners as part of an onboarding process or as a streamlined way to get to know the watershed. By providing the information in one place, it can help people get up to speed more quickly on what is currently understood about the watershed, where there are gaps, and what roles or projects the watershed group might take on in supporting watershed health.

Sharing the project more broadly with the public may also be a project goal, especially as part of a community engagement process. (See Chapter 3 subsection [Gathering feedback and community engagement](#).) It may be valuable to hold one or more community presentations to share the project and product(s), gather feedback, identify next steps, and build additional support. The project can also be promoted more widely by connecting with local media, publishing press releases, connecting with local or regional partners to share with their email lists, and more.

To support these goals, the final watershed characterization products should be accessible to these audiences. Most watershed characterizations will be published online and they may also be published or linked on different partners' websites for more visibility. The "reference library" of information and files can also be publicly accessible through links to online file storage or sharing (for example, Google Drive or Dropbox). Maps can be printed and displayed publicly, such as at the town hall or as part of community event tabling materials. The watershed characterization report can be printed, with hard copies provided to key partners, such as watershed group members, municipal boards, and others that may benefit from easy access to reference and use a printed copy. Printed copies can also be archived in local libraries, by agencies, or in other physical locations that can help preserve institutional knowledge.

Identifying project opportunities

While it is very beneficial to identify projects through a watershed planning process, specific and targeted priority next steps and project ideas can also be generated through insights learned through the watershed characterization process. As discussed in the Chapter 1 subsection [Understanding watershed problems to develop solutions](#), it is important to understand known challenges and any information gaps before prioritizing those problems and identifying potential solutions. The watershed characterization helps provide "the big picture" to contextualize project opportunities ([Shilling et al. 2004](#)).

Identifying and implementing watershed management projects is often an iterative process. Implementing strategic and larger-scale restoration projects may hinge on the consensus-building, relationships, and grant funding that becomes available through a complete watershed planning process. At the same time, there is significant value in undertaking smaller-scale projects that address priorities and can contribute to positive momentum and public support ([Shilling et al. 2004](#)). Early successes can motivate more action, and some larger-impact actions will rely on initial work having been completed ([Shilling et al. 2004](#)). Available opportunities, alignment with partner workplans, and the ability/ease to manage and complete beneficial projects should be considered when planning next steps.

Specific next step projects following a watershed characterization process may include plans, policies, on-the-ground restoration projects, land conservation or protection, community education and outreach work, and other projects that result in positive outcomes for the watershed ([Shilling et al. 2004](#)). These may be led or supported by a different set of partners with different skills, expertise, or roles than the project team and advisory committee that developed the watershed characterization.

If the watershed characterization identified data or information gaps, collecting new data or information can be a next step coming out of the watershed characterization process. These may include geographic or temporal gaps, information that is out of date, or new methodologies or tools that are now available to better understand current watershed conditions. Next steps may include developing new studies, research, or monitoring projects to collect or understand relevant information. This can also include additional analysis or interpretation; for example, a separate report might focus on interpreting specific water quality findings from across the sources included in the watershed characterization. Follow up reports can be especially helpful if new data are available or are updated more frequently than the watershed characterization.

Additional planning or design work within the watershed may also be a next step. This may include municipal-scale planning, more detailed engineering studies, reach-scale plans, site-specific design work, etc. For more information on additional watershed-scale plans, see the Chapter 6 subsection [From watershed characterization to plan](#) below. Future planning may also be supported by the information gathered within the watershed characterization. For example, the Punch Brook-Roeliff Jansen Kill watershed characterization supported municipal-scale planning work that was just getting underway on the Town of Ancram's Open Space Plan. Having GIS data and other information from the Town of Ancram already compiled and available helped speed up that process to inform local decision-making.

The watershed characterization process might also highlight opportunities for local policies to support watershed goals. This is especially the case if the watershed characterization process followed the NYS DOS work plan and included a process to describe and assess local laws. (For more information, see the Chapter 2 subsection [Watershed characterization guidance from NYS](#)

[DOS](#). Opportunities may include wetland/watercourse protection, overlay zoning, critical environmental areas, and a number of other policy tools.

NYS DOS provides guidance on [Model Local Laws to Increase Resilience](#), which can be adapted by individual municipalities to meet their needs. Available chapters include:

- [Basic Land Use Tools for Resiliency](#)
- [Wetland and Watercourse Protection Measures](#)
- [Coastal Shoreline Protection Measures](#)
- [Management of Floodplain Development](#)
- [Stormwater Control Measures](#)

It is likely that many restoration or other implementation projects will require longer-term planning, buy-in, and investment (see Chapter 1 subsection [Understanding watershed problems to develop solutions](#)). However, there may also be opportunities for certain on-the-ground projects to be identified as next steps following the watershed characterization process. These can include projects that have already been prioritized by municipal, local, or regional partners, including through other aligned planning efforts. The watershed characterization may provide additional support for undertaking projects, including providing context when discussing with communities or submitting as justification within a grant application for planning, design, or implementation. Successful implementation of smaller-scale projects can help build momentum and support projects that require more time and resource investment. When considering implementation project opportunities, it is important to consider if projects could cause unintended harm or maladaptation without more detailed planning or design work.

Examples of on-the-ground implementation projects following a watershed characterization could include tree planting, culvert right-sizing, or small scale green infrastructure stormwater management projects. The [Hudson Estuary Trees for Tribs Program](#) offers free native trees and shrubs for qualifying planting projects along streams that are tributary to the Hudson River estuary. Many watershed groups participate in this program, working with local landowners and other partners to identify sites, find volunteers, and help maintain plantings. The watershed characterization process could be used to identify and target areas for tree plantings and riparian restoration, including using the [Statewide Riparian Opportunity Assessment](#).

Watershed management priorities and opportunities can change quickly based on changes in available programs, partners, capacity, resources, and so on. It can be valuable to regularly revisit potential projects by developing a workplan, either specifically for the watershed group or for a collaboration with different partners. For more information on creating a workplan, see the Hudson River Watershed Alliance and River Network's [Organizational Health Self-Guided Learning Series - Episode 4: Budgets & Workplans](#). Next steps may also include additional relationship-building between potential partners, mechanisms to support ongoing coordination between partners, and community engagement processes.

To support future projects coming out of a watershed characterization process, watershed groups may want to focus on capacity-building as a next step. Investing in organizational development can help watershed groups take on more complex roles in project development and implementation, with greater impact. Many resources are available through the [Organizational Health & Growth: Self-Paced Learning](#) series developed specifically for Hudson Valley watershed groups by the Hudson River Watershed Alliance and River Network. This series includes organizational development and growth checklists, short video modules on priority topics, worksheets, templates, and links to additional resources. Watershed groups may also consider additional internal planning tools, such as strategic workplans, strategic plans, or scenario planning to consider what different futures may hold ([Vail et al. 2024](#)).

From watershed characterization to plan

The watershed characterization process may be a starting point that leads to a more involved watershed planning process. A full watershed planning process is very valuable in bringing people and partners together, identifying priorities, setting goals, and working towards a shared understanding of management steps. It can also build relationships, grow consensus, and open up grant opportunities. For more information on watershed planning, see the Chapter 2 subsection [What is a watershed plan?](#)

A complete watershed plan sets a clear list of priority next steps that are grounded in science and the current watershed conditions understood through the watershed characterization. It includes goals and objectives, strategies, and an implementation plan. Depending on the watershed plan's funding source and framework, a complete watershed plan may also enable municipalities and other partners to be eligible for grant funding to implement those identified projects. For more information on the value of undertaking a watershed characterization as the foundation for a complete watershed plan, see Chapter 1 subsection [Benefits of watershed characterization: Building momentum for watershed planning and implementation](#).

The primary funding source for watershed planning in New York State is through NYS DOS's [Local Waterfront Revitalization Program](#) (LWRP). Watershed plans are considered a non-regulatory "component" of an LWRP. NYS DOS grants can fund two different types of watershed plans: 9 Element watershed plans and DOS watershed management plans. For more information on watershed planning and frameworks used in New York State, see [Chapter 2: Watershed Planning Frameworks in New York State](#).

NYS DOS-funded watershed plans, either a 9 Element watershed plan or a DOS watershed management plan, are approved by NYS DOS. Once approved, NYS DOS LWRP implementation grants are available to implement watershed plan priorities. These funds may be used for planning, design, and/or construction of priority projects. To be eligible, the watershed plan must have been substantially completed with NYS DOS. Funded implementation projects can be phased, with earlier design work completed before construction. NYS DOS priorities and grant

details can change from year to year; for the most up-to-date details and workplans, please refer to materials available on the [NYS Department of State website](#).

Examples of watershed planning implementation projects funded by NYS DOS in past years include (Katherine Black, personal communication, April 27, 2026):

- [Cayuga Lake Watershed Restoration & Protection Plan](#) (2017):
 - Reviewed their intermunicipal organization framework.
- [Ausable River Watershed Management Plan](#) (2016):
 - Developed a stewardship brochure used for public outreach.
- [Canandaigua Lake Watershed Management Plan](#) (2014):
 - Created a stormwater wetland to mitigate extreme weather events and improve water quality.
 - Reconnected floodplains in the Naples Creek sub-watershed through right-sizing culverts, removing debris jams, and opening access to hundreds of acres of additional floodplain area to reduce flood risk.

In addition to NYS DOS approval and implementation funding, 9 Element watershed plans that are funded by NYS DOS and approved by NYS DEC also open up opportunities for potential grant funding to implement projects. Implementation projects that are identified in approved 9 Element watershed plans are eligible for additional points or incentive payments in various state grant programs, including the NYS DEC's [Water Quality Improvement Project \(WQIP\)](#) grant program and the NYS Department of Agriculture and Markets' [Source Water Buffer Program](#) and [Agricultural Nonpoint Source Abatement and Control Program](#). Approved 9 Element watershed plans that are funded by NYS DOS are eligible for NYS DOS LWRP implementation grants, but do not receive additional points or priority for funding.

As discussed in Chapter 3 subsection [Funding for watershed characterization](#), the Hudson River Valley Greenway provides grants for local and regional planning projects in the Greenway Area through the McHenry Community Planning Grant Program. These grants can build on each other to set up opportunities for funding to continue project work, including developing a watershed characterization followed by a complete watershed plan. More information is available on the Hudson River Valley Greenway's [McHenry Community Planning Grants website](#).

Next steps may also include other watershed-scale plan approaches. If the watershed includes source(s) of drinking water for public water supplies, the [Drinking Water Source Protection Program \(DWSP2\)](#) may be a good fit. Through this NYSDEC and NYSDOH program, municipalities can apply for free technical assistance to develop drinking water source assessments and plans.

If flood resilience is a high priority for the watershed, a Flood Mitigation & Resilience Report can investigate the causes of flooding and help identify specific projects as next steps. Watersheds with significant flooding and related hazards to public safety and environmental health that are enrolled in the NYS DEC's [Resilient NY Streams](#) program will receive technical assistance to create a Flood Mitigation & Resilience Report. Once approved by NYS DEC, implementation

projects identified in Resilient NY Flood Mitigation & Resilience Reports are eligible for the [Resilient Watersheds Grant Program](#). Communities can also undertake their own flood resilience studies using a similar workplan; if approved by NYS DEC, these are also eligible for implementation funding through the Resilient Watersheds Grant Program.

Watershed communities will need to continuously assess new information, opportunities, and priorities as they emerge. A watershed plan is not a cure-all to watershed problems. Instead, it provides a process to convene partners and a shared understanding of conditions (through the watershed characterization) to collectively find answers and improve solutions over time ([Shilling et al. 2004](#)).

Key Points

Key points from Chapter 6: Using a Watershed Characterization for Next Steps include:

- Once the watershed characterization process is complete, next steps can include sharing the watershed characterization products with priority audiences, identifying specific project opportunities, and using the watershed characterization as the foundation to develop a complete watershed plan.
- Sharing the watershed characterization and the story it tells will rely on bringing the watershed characterization and its materials or messages to specific audiences. A wide range of decision-makers and partners can benefit from learning about the watershed characterization process and its findings, and can also provide valuable feedback to inform next steps.
- While it is very beneficial to identify and prioritize projects through a complete watershed planning process, specific next steps and project ideas can also be generated through insights learned through the watershed characterization process. Examples include collecting additional data to fill in gaps, interpreting compiled information, undertaking more detailed plans or design work, implementing local policies to support watershed goals, and on-the-ground restoration projects. When considering implementation project opportunities, it is important to consider if projects could cause unintended harm or maladaptation without more detailed planning or design work.
- The watershed characterization can lead to a more involved watershed planning process and become a part of a watershed management plan. The watershed planning process can be very valuable in building relationships and buy-in, identifying priorities, setting goals, and working towards shared implementation and management.
- A complete watershed plan funded and approved by NYS DOS is eligible for implementation funding, and 9 Element watershed plans approved by NYS DEC are eligible for additional points or incentive payments in various state grant programs.

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Appendices

Appendix A: Watershed Characterization Templates

From 2022-2024, the Hudson River Watershed Alliance worked with local Advisory Committees to create watershed characterizations for the Sparkill Creek watershed and the Punch Brook-Roeliff Jansen Kill watershed. The process in each watershed included organizing a project advisory committee, delineating the focus watershed, gathering existing data, and organizing and summarizing the information into a written report. The watershed characterization pilot project was supported by funding from the Hudson River Estuary Program, New York State Department of Environmental Conservation, with support from the New York State Environmental Protection Fund, in cooperation with NEIWPCC.

The Hudson River Watershed Alliance began the process by soliciting applications to provide technical assistance to develop a watershed characterization, adapting the process outlined in the NYS Department of State and Department of Environmental Conservation *Guidebook on Watershed Plans*. Eligible watersheds included those that: 1) were located within the Hudson River estuary watershed, 2) were HUC 12 size or smaller (based on US Geological Survey delineation), and 3) included at least two local municipalities, in addition to the county or counties. The project team intentionally selected one rural watershed (Punch Brook-Roeliff Jansen Kill) and one urban watershed (Sparkill Creek) to better understand watershed issues, data availability, and ways to organize this information across a range of land uses.

The Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization pilot projects took approximately two years. As part of the application for technical assistance, each watershed identified members of their advisory committee. Each project started with a kick off meeting, to explain the process and make sure the right people were at the table. After the kick off meeting, additional advisory committee members were invited to participate.

Each watershed's advisory committee met four times after the project kick off meeting. Between meetings, the Hudson River Watershed Alliance worked with consultants (Strong Outcomes, LLC and Green Goat Maps) to develop products for the Advisory Committee to review and provide feedback. These included watershed characterization fact sheets at the start of the project, an outline for the watershed characterization report, draft maps, and draft report narrative.

Each watershed characterization pilot project included a community presentation to share the work with the broader public. Each community presentation included displaying the maps; sharing information about the watershed characterization process and product; presentations from the watershed group on next steps and how to get involved; and an opportunity for participants to share their questions, concerns, ideas, gaps in information, what excites them, and next steps. Recordings of the community presentations are available below.

These reports were designed to serve as templates for future watershed characterizations, including the way the information is organized/table of contents, map themes and symbology, background information in various sections, and links to reference material that may be useful for other watershed characterizations in the Hudson River watershed. Templates can serve as a starting point, so that more energy and time can be focused on decision-making conversations to adapt the templates to better address local needs and interests, rather than starting from scratch ([Meierdiercks et al. 2025](#)). This is intended to reduce workload burdens and “decision fatigue” at the beginning of the planning process, enabling more time and capacity to customize maps and other characterization materials to best achieve local goals.

Table 5 includes links to each watershed characterization report to use as a template, along with links to additional project materials and context for understanding which template might be a better fit to use for your watershed. The watershed characterization pilot projects also informed:

- [Appendix B: Sample Watershed Characterization Maps and Layers](#) - copies of each map in the watershed characterization reports, with lists of the GIS data layers used
- [Appendix C: GIS Data for Watershed Characterization Maps](#) - compilation of links to specific GIS data files used in each watershed characterization map
- [Appendix D: Information Checklist for Watershed Characterization Report](#) - types of information referenced in the watershed characterization reports

Table 5. Comparison of the watershed characterization pilot projects (Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterization projects), with links to template reports, presentations, and other resources.

	Punch Brook-Roeliff Jansen Kill	Sparkill Creek
Watershed characterization report Maps	Punch Brook-Roeliff Jansen Kill Watershed Characterization Report (2024) Maps (PDFs) Maps (.pngs)	Sparkill Creek Watershed Characterization Report (2024) Maps (PDFs) Maps (.pngs)
Presentation at Watershed Characterization & Planning Workshop	“Punch Brook Characterization: Process and Lessons Learned” by Colleen Lutz (3/24/26) Recording Slides	“Starting a Watershed Plan for the Sparkill Creek” by Larry Vail (3/24/26) Recording Slides
Community presentation to share the project	Community Presentation video recording from Ancram Town Hall (4/25/24)	Community Presentation video recording from St. Thomas Aquinas College (3/25/24)
Project fact sheets	Project fact sheet (2022)	Project fact sheet (2022)
Land use type	Rural	Urban/suburban
Counties	Columbia County and Dutchess County, NY	Rockland County, NY and Bergen County, NJ
Watershed size	47.5 square miles, 6 municipalities	11.2 square miles, 6 municipalities
Delineation type	HUC 12 portion of larger watershed	Used previous plan’s delineation
Local lead	Colleen Lutz, Town of Ancram and Roe Jan Watershed Community	Larry Vail, Sparkill Creek Watershed Alliance
Project management	Emily Vail, Hudson River Watershed Alliance	
Writing/organizing information	Hudson River Watershed Alliance, with support from Strong Outcomes, LLC	
Cartography/Maps	Green Goat Maps, with support from Kate Meierdiercks, Siena University	
Funding source	Supported by funding from the Hudson River Estuary Program, New York State Department of Environmental Conservation, with support from the New York State Environmental Protection Fund, in cooperation with NEIWPCC.	

Appendix B: Sample Watershed Characterization Maps and Layers

[Appendix B: Sample Watershed Characterization Maps and Layers](#) lists the GIS data layers that were used to create each of the Sparkill Creek, Punch Brook-Roeliff Jansen Kill, and Fishkill Creek watershed characterization maps. Clicking on the thumbnail image will open up a full-sized PDF of each map. Direct links to these GIS data layers are provided in the [Appendix C: GIS Data Checklist spreadsheet](#).

The maps created for each watershed depend on the goals of the watershed characterization and the unique characteristics of the watershed. For example, the Sparkill Creek, a more urbanized watershed, does not have an Agriculture map, whereas the Fishkill Creek includes a Recreation map, which was requested by the local watershed group.

The Fishkill Creek watershed maps were developed in summer 2024, as an opportunity to understand 1) watershed characterization mapping in a larger watershed with more mixed land uses and 2) opportunities for watershed group-academic partnerships, especially for students to gain hands-on experience supporting watershed characterization mapping. The Fishkill Creek watershed is 193 square miles, compared to the 47.5 square mile Punch Brook-Roeliff Jansen Kill watershed and the 11.2 square mile Sparkill Creek watershed. The student partner on this project had completed a one-semester introductory GIS course and was hired to create the initial map series over the summer for course credit, with advising from a faculty mentor. Additional information about the Fishkill Creek watershed maps and methodology is included in [Appendix F: Resources to Engage Students in Watershed Characterization Projects](#).

Appendix C: GIS Data for Watershed Characterization Maps

Appendix C includes both a list of databases and resources to access relevant GIS files and a spreadsheet of specific GIS data layers for watershed characterization mapping and summary statistics.

The list of [Watershed Characterization GIS Databases and Sources](#) includes descriptions and links to websites that may be useful to search for GIS data layers to include in the watershed characterization. These are sites that have many GIS data layers available, such as the New York State GIS Data Clearinghouse. More GIS layers are available through these resources than are listed in the Appendix B spreadsheet, and new relevant layers may be added and available over time. The databases are searchable, and in many cases, the layers are viewable online without having access to specialized GIS software.

In the [GIS Data Checklist spreadsheet](#), the GIS data layers used for the Sparkill Creek, Punch Brook-Roeliff Jansen Kill, and Fishkill Creek watershed characterization maps are listed by map type. Direct links to access each GIS layer are included. These links are up-to-date as of the publication of this guidance document. In many cases, images of the data layers or access to the layers are available to view online without specialized GIS software. A template spreadsheet to track and organize GIS data used within the watershed characterization is [available here](#).

Appendix D: Information Checklist for Watershed Characterization Report

[Appendix D: Information Checklist for Watershed Characterization Report](#) is a suggested checklist of information that might be included within the watershed characterization report's narrative or charts. This checklist is designed to supplement the materials in [Appendix C: GIS Data for Watershed Characterization Maps](#). The information listed in Appendix D can be collected by someone who does not have access to GIS.

This checklist was developed based on the types of information that were included within the Punch Brook-Roeliff Jansen Kill and Sparkill Creek watershed characterizations.

A template spreadsheet to track and organize information used within the watershed characterization is [available here](#).

Appendix E: Worksheets to Identify Watershed Characterization/Planning Next Steps

On March 24, 2026, the Hudson River Watershed Alliance held an interactive half-day Watershed Characterization & Planning Workshop at The Heartwood at Vassar College in Poughkeepsie. The workshop focused on advancing locally-led watershed characterization, planning, and implementation across the Hudson River watershed.

As part of the workshop, in-person participants took part in a facilitated interactive working session led by Karen Strong of Strong Outcomes, LLC. During this session, participants applied workshop concepts to their own contexts using self-assessment worksheets designed to identify appropriate next steps in watershed characterization or planning. A PDF copy of the [Interactive Working Session to Identify Next Steps](#) presentation slides and [additional workshop materials](#) are available on the Hudson River Watershed Alliance website.

The worksheets are designed to support reflection, assessment, and action planning for people interested in watershed characterization and planning, **no matter where they are in the process, and whether or not they are working with a local watershed group**. Each worksheet is designed as a self-assessment, with space for reflection on what the responses mean for an individual's next steps. There are no right or wrong answers; the intent is to support honest reflection and informed decision-making.

Which Worksheet Should I Use?

The three worksheets address different planning contexts and roles. Worksheet 1 focuses on individual self-assessment to help people clarify how they might support or engage in watershed characterization or planning, and may be a good fit for regional partners. Worksheets 2 and 3 are designed to support group-based reflection and discussion tied to a specific watershed effort. While these worksheets were designed to support watershed characterization and planning, they may also be valuable for identifying next steps in other types of conservation planning processes.

[Worksheet 1](#): Supporting Watershed Characterization or Planning

This worksheet will help individuals or organizations who are interested in supporting a locally-led watershed characterization or plan to **identify the different types of contributions they can make**. Worksheet 1 is intended for anyone who is not currently working with a specific locally-led watershed group, including staff from state or county agencies, regional nonprofit organizations, academic institutions, or interested community members.

[Worksheet 2](#): Preparing to Begin a Watershed Characterization or Plan

This worksheet helps individuals and groups preparing to pursue a watershed characterization or plan think through their approach and choose a focus and process that best meets their needs. Worksheet 2 is intended to be used by locally-led watershed groups and their partners **before project work begins for a specific watershed**.

[Worksheet 3](#): Reflecting on a Project in Process and Preparing to Implement

This worksheet is designed to help people or groups that are working on, or have completed, watershed characterizations or plans to reflect on the planning process and identify key actions to strengthen outcomes and advance their work. Worksheet 3 is intended to be used by locally-led watershed groups and their partners **once a specific watershed’s characterization or plan is underway or complete.**

These worksheets were inspired by materials prepared by River Network and Strategic By Nature to support stream management plans in Colorado, and adapted for use in the Hudson Valley by Karen Strong, Principal, Strong Outcomes, LLC. Original materials include:

- [Self-Assessment: Identifying the Strengths and Limits of Your Plan / Process](#): developed by Stacy Beaugh, Strategic By Nature, Inc., and modeled after the “[Watershed Planning Wheel](#)” and other planning resources. This self-assessment was created as part of the 2025 workshop on [Taking Plans to Projects: How to Create a Plan that Actually Gets Used](#), hosted by River Network's Watershed Planning Peer Learning Network.
- [Pre-Planning Questions for Stream Management Plans](#): developed by River Network to help people think through why you are undertaking a planning process, who should be at the table, and what information you should know before you begin.
- Additional resources are available through the [Stream Management Plan Resource Library](#), hosted by River Network and the Colorado Water Conservation Board. While these materials are focused on stream management planning, the same process guidance is relevant for watershed management plans.

Additional materials from the March 24, 2026 Watershed Characterization and Planning Workshop, including presentation recordings, PDF copies of slides, and related resources, are available on the [Hudson River Watershed Alliance’s website](#). A complete playlist of workshop presentations is also available on the [Alliance’s YouTube channel](#).

Appendix F: Resources to Engage Students in Watershed Characterization Projects

Appendix F includes resources for students and their faculty mentors wishing to complete watershed characterization maps as a guided research or course project.

A peer-reviewed article, [Watershed Characterization to Enhance Student Learning and Build Capacity for Community-Led Watershed Planning and Management](#) (Meierdiercks et al. 2025), presents the Fishkill Creek Watershed Characterization mapping process as a case study. The project team included university staff (Clarkson University's Beacon Institute staff), a regional watershed partner (Hudson River Watershed Alliance), an undergraduate GIS student (Siena University, faculty mentor (Siena University), and volunteer members of the Fishkill Creek Watershed Alliance. The article describes the process of completing the initial watershed characterization maps through an academic-community partnership, lessons learned, and how partnering with a local watershed group can be mutually beneficial to both the faculty-student team and the watershed group.

The guidance document, [Watershed Characterization Guidance Document for Students and their Mentors](#) (Meierdiercks 2025), was written by Dr. Katherine Meierdiercks from Siena University to provide additional process details to help students and their faculty mentors in creating watershed maps in support of community-led watershed characterization, planning, and management. Appendix 1 of the student and mentor guidance document shares resources on best practices and additional guidance for collaboration and academic-community partnerships.

Pace University's Pocantico River Watershed Characterization is also a valuable case study for engaging undergraduate students in a watershed characterization. This work was led by a team of undergraduate students, with Dr. Michael Rubbo from Pace University's Department of Environmental Studies and Science serving as the faculty lead. The project included gathering existing information, conducting new studies to better understand ecological conditions, and understanding community perspectives. At a [2026 "Breakfast Webinar: A Student-Led Characterization of the Pocantico River Watershed,"](#) Dr. Rubbo discussed the benefits and challenges of this approach, and shared suggestions for improving these techniques. The Pocantico River Watershed Characterization is available as an [ESRI StoryMap](#), designed to share information with municipal officials, environmental leaders, and community members, as well as a [PDF report](#).

Appendix G: Overview of watershed management plans from three U.S. regions

In spring 2025, graduate students from Bard College’s Center for Environmental Policy worked with the Hudson River Watershed Alliance to better understand watershed management planning best practices. As part of the "Politics of Solutions" course, nine graduate students (Srijan Banik, Kiara Carman, Jenna Holub, Emily Inoue, Pazao Lee, Annabel Posimato, Liz Riley, Brenden Schaaf, and Logan Tondini) interviewed 21 different stakeholders from three regions across the United States: the Northwest, Northeast, and Great Lakes. These regions were selected for their diverse governance models and experience addressing hydrological and environmental challenges similar to those in New York State.

The final report, [*Does Policy Sink or Swim? An overview of watershed management plans from three U.S. regions*](#), shares a regional overview and challenges facing each of the three regions, regulatory frameworks and governance, challenges and successes, and key takeaways (Banik et al. 2025). The report also summarizes best practices and recommendations from across the interviews, along with [examples of particularly strong watershed management plans](#).

The student authors also presented their findings at a Hudson River Watershed Alliance breakfast webinar on May 8, 2025, which is available on the [Hudson River Watershed Alliance’s YouTube channel](#). A PDF copy of the presentation slides are also [available](#).