

# Boonton Reservoir

## Protection and Trail Project

NOVEMBER 2019



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## Plan Developers



The Morris County Park Commission is responsible for administration, development and maintenance of over 20,000 acres of parks and trails in Morris County. Their mission is to develop and preserve a dynamic and unique system of diverse, natural, cultural and historic resources, and to provide innovative education and recreation opportunities of regional value, while exercising environmental and fiscal responsibility.

The Open Space Institute (OSI) protects scenic, natural, and historic landscapes to provide public enjoyment, conserve habitat and working lands, and sustain communities. Founded in 1974 to protect significant landscapes in New York State, OSI is a leader in environmental conservation, having partnered in the protection of nearly 2.2 million acres in North America, from Florida up the spine of the Appalachians to southern Canada.

Greener by Design, LLC. (GbD) is an environmental consulting and energy asset management firm with a wide variety of project experience. GbD's open space and planning division focuses on conservation, economic development through eco-tourism, and site enhancements, like trails and parks. All uncredited images in this report were generously provided by Greener by Design

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## Introduction

In September 2018, the Jersey City Council passed City Ordinance 18-04 authorizing a 40-year lease agreement with the Morris County Park Commission (MCPC) to develop and manage a passive recreational trail around the Boonton Reservoir, located in Morris County, New Jersey. The ordinance requires the MCPC to draft a Property Management Plan (PMP), for further approval by the Council, outlining the details of the proposed trail. What follows is the PMP, developed by the Open Space Institute in partnership with MCPC and with help from Greener by Design, which recommends the security, environmental, management, and design conditions necessary to safely and successfully open the site to public access. The PMP provides a comprehensive guide for the construction, operation, and maintenance of a public trail at the Boonton Reservoir site, establishes procedures for responsible stewardship of the Reservoir, and outlines a strategy for maximizing the public benefits of this project. All funding for the design, construction, and operation of the trail will come from the MCPC and philanthropic supporters.

### **We wish to thank the following stakeholders who have contributed to the development of the Property Management Plan:**

- ~ Mayor Steven Fulop of Jersey City
- ~ Jersey City Office of Sustainability
- ~ Jersey City Environmental Commission
- ~ Jersey City Police Department
- ~ Jersey City Municipal Utilities Authority
- ~ Jersey City Office of Emergency Management
- ~ Mayor Michael Soriano of Parsippany-Troy Hills
- ~ Township of Parsippany-Troy Hills Council
- ~ Township of Parsippany-Troy Hills Police Department
- ~ Township of Parsippany-Troy Hills Fire Department
- ~ Township of Parsippany-Troy Hills Office of Emergency Management
- ~ Mayor Matthew DiLauri of Boonton
- ~ Town of Boonton Board of Aldermen
- ~ Town of Boonton Police Department
- ~ Town of Boonton Fire Department
- ~ Morris County Prosecutor's Office - Critical Infrastructure
- ~ Morris County Department of Law & Public Safety
- ~ Hudson County
- ~ Hudson County Prosecutor's Office
- ~ Suez North America
- ~ New Jersey DEP's Division of Fish & Wildlife - Endangered and Nongame Species Program
- ~ New Jersey DEP's Bureau of Dam Safety
- ~ NJ Office of Homeland Security
- ~ NJ Highlands Council
- ~ New Jersey Watershed Property Review Board
- ~ Great Swamp Watershed Association





*Looking southwest over the Boonton Reservoir. Credit: Jack Morningstar*

## Executive Summary

This Property Management Plan (PMP) provides a guide to the construction and operation of the proposed Boonton Reservoir Trail; suggests infrastructure investments and long-term best management practices to address natural resource conservation; and makes recommendations for regulating public access and increasing security at the Boonton Reservoir in Morris County, New Jersey. All funding for the design, construction, and operation of the trail will come from the Morris County Park Commission (MCPC), philanthropic supporters and grants.

### **Broad Public Benefits**

The Boonton Reservoir Protection and Trail Project will have important public benefits, including the creation of new opportunities for public recreation, enhanced security at the Reservoir site, and improvements to the environmental conditions on the Reservoir property. For the nearly 15,000 local residents who live nearby, opening the Reservoir trail will provide a high-quality resource for walkers and nature lovers. For Jersey City residents, installation of new drainage solutions and native plantings will reduce stormwater runoff and improve ecological conditions at the site. For both, allowing the public to enjoy limited use of the site will facilitate cooperation between one of New Jersey's great urban centers and the communities that support the protection of its drinking water supply.



### Trail Design

The trail will be a 7.7-mile loop, made of natural pervious materials, to be constructed in phases. Public access to the site will be limited to a narrow trail corridor and permitted uses will include only passive activities such as walking, running, and cross-country skiing. Interpretive signage detailing the Reservoir's history and the property's natural features will be placed along the trail to educate the public.

If the MCPC can secure the necessary funding, a portion of the trail will be ADA-accessible, providing access to those challenged by a traditionally-constructed trail such as those with physical limitations, the elderly, and families with small children.

Five access points to the trail are proposed – three with dedicated parking, one designed for foot traffic only, and one auxiliary parking area that could be opened upon future need. The trail will have a clear and attractive wayfinding system to provide navigation assistance for visitors and guidance for emergency first responders.

### Security

The Parsippany Police Department, the Boonton Police Department, the Morris County Park Police, and Suez will coordinate on both day-to-day monitoring of the site and incident response. The Parsippany Police Department will conduct daily patrols of the property. The entire trail will be constructed to permit the passage of all-terrain vehicles used by first responders.

The critical infrastructure and Reservoir waterbody will be protected with strategic placement of fencing, cameras, and signage. Parking areas will be located across the public street from critical infrastructure to address security concerns. The appropriate Offices of Emergency Management, the NJ DEP's Dam Safety Office, and NJ Department of Homeland Security are aware of the proposed PMP, have approved of the concepts presented, and will review and approve the details once finalized.

### Maintenance and Regulations

The trail will be managed, maintained, and regulated by the MCPC. Responsibilities will include maintaining the trail infrastructure, maintaining environmental improvements, securing public access, trash collection, and providing and maintaining other user facilities such as sanity facilities and benches. Regulations on the use of the trail will be strictly enforced by the Morris County Park Police, a division of the MCPC.

### Resource Management and Ecological Improvements

The trail will be designed with natural resource protection as a foremost priority, ensuring the trail does not impede on sensitive areas or threatened species. At least 2-3 stormwater runoff improvement features will be incorporated into the design of the trail, such as bioretention basins, catchment areas, and other facilities that will trap floating debris and remove contaminants. Invasive species removal and pollinator plantings, subject to funding availability, will enhance the natural resources on the property. Strategic deer management techniques will be necessary to ensure the survival of native plantings.

The details of the routing and design of the trail are subject to change as the project proceeds through the various approval processes that govern the trail design and construction. This process is anticipated to take place from January 2020 – early 2021. Additionally, some components of the PMP may be subject to funding availability. Throughout this report, indications are made where project components are final or subject to change. The overarching goal - to provide public access, and to improve the security and ecological health of the property – will not change.

The final design and routing of the trail will require approval by the following entities prior to construction:

- The New Jersey Watershed Property Review Board
- The New Jersey Department of Environmental Protection (NJ DEP)
- The Jersey City Municipal Utilities Authority (JC MUA)
- The Jersey City Office of Emergency Management (JC OEM)





*Historic photo of temporary railroad used in construction of the Boonton Dam. Credit: Courtesy of Boonton Historical Society*

## Chapter 1: A Brief History of Boonton and the Reservoir

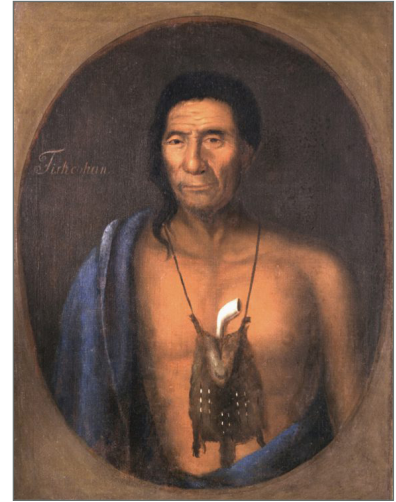
### **CHAPTER OVERVIEW**

- The Boonton Reservoir is located in an area of importance for both indigenous and colonial history.
- The Reservoir was completed in 1902, after a Typhoid outbreak in Jersey City caused the city to develop new drinking water supplies.
- From 1996-2001, the Reservoir was open to the public for fishing with a permit.
- The Boonton Reservoir has a surprisingly storied past, giving rise to a number of rumors about what lies underneath. The Reservoir is located over the site that was once the Town of Lower Boonton. Contrary to popular belief, a church steeple does not appear during periods of drought and the Town of Lower Boonton is not preserved under the 7.2 billion gallons of water. However, remnants of the town can still be found, though mostly just foundations.

## History of Boonton

Before Europeans arrived, New Jersey was inhabited by several different tribes and ethnic groups including the Raritans, Navasink, Aquackanoncks, Espouses, and Minisinks. European settlers lumped these people under the term Delaware Indians, also known as the Lenape, which translates to “Common People” or “ordinary” in Eastern Algonkian. Most Native American tribes in the Northeast spoke different dialects of Algonkian, though they shared many regional cultural traditions. It is likely that a tribe of Munsee dialect speakers of the Lenape inhabited the area, where they used the river’s abundant resources.

Lower Boonton was known simply as “The Falls” when it was purchased by John Bale, Daniel Deton, and Tulic Watson from Native Americans Taphaow and Manshiem in 1664. The land was later renamed by Daniel Ogden in honor of New Jersey’s Colonial Governor Thomas Boone in 1759. However, no record of this purchase exists, though historians cite a payment of 36 pounds and 14 shillings for the property – an inconceivably small amount that is the equivalent of about £5,529 or \$6,970.38. Since then, the settlement has gone by several different names, including Boonetown, Booneton, Boonton Falls, and Old Boone Town.



*Tishcohan was a descendant of Taphaow and Mansheim, who were two of the most important sellers of the land in the Boonton area deeds.*

*Credit: Courtesy of the Philadelphia History Museum at the Atwater Kent, The Historical Society of Pennsylvania Collection*



*Old Boonton Paper Mill. Credit: Courtesy of Boonton Historical Society*

Positioned on the Rockaway River, a tributary of the Passaic River with access to abundant natural resources, Lower Boonton easily industrialized. The Boone Town Iron Works was established along the river in 1710 by Obadiah Baldwin

and his son Samuel, using waterpower and raw materials like iron ore and wood. Four dams were built across the Rockaway to supply water and power to mills and furnaces, allowing the Boone Town Iron Works to serve as the largest iron works and chief source of munitions and metal supplies in Colonial America during the Revolutionary War.

After the war, businessmen from New York City and England continued to industrialize Lower Boonton, attracted by the power, transportation, and natural resources afforded by the Rockaway River. New iron mills were constructed along the river, as the town gradually shifted upland. New industries emerged, supported by the development of the Morris Canal and the Lackawanna Railroad, which connected Lower Boonton to the City of Paterson. Residents continued to develop and settle on the surrounding hills.

### The Jersey City Water System

Nearby, Jersey City was struggling to manage its drinking water supply. The city sourced its water from the extremely polluted Passaic River, which resulted in a deadly typhoid outbreak in 1891. As a result, the city negotiated the purchase of the Lower Boonton valley in the late 1890s. By 1899, the Jersey City Water Supply Company had purchased the land for \$85,000. In order to construct the Reservoir, the dam was built less than a mile downstream and completed in 1902, relying on manpower, horses, and steam engines.

The Rockaway & Montville Railroad Company was formed to facilitate the building of the dam, with temporary railroads carrying rock three miles from the quarry at Hog Mountain in Montville to the dam. The Reservoir basin was completely cleared of all buildings, structures, roads, and trees. Only tree stumps and building foundations remained by the time the Reservoir was filled. A new bridge built in 1903 connected Washington Street to the road to Morristown and has since been refurbished twice, now serving exclusively as a pedestrian bridge. The pipeline from the Reservoir to Jersey City was opened on May 26th, 1904.



*Dam workers around 1900 standing on shale foundation before the core of the dam was laid. Credit: Courtesy of Boonton Historical Society*

In order to distribute water from the Boonton Reservoir to Jersey City, engineers constructed two eight-foot wide pipelines and aqueducts that extended 26 miles. This infrastructure was installed after engineers blasted through solid rock in Hook Mountain, Watchung Mountain, and Great Notch.



The Boonton Reservoir Dam was considered an engineering marvel at the time it was constructed. The Jersey City Water Supply System in its entirety was a groundbreaking accomplishment. The upper reservoir at Split Rock in Rockaway Township, the Boonton Reservoir, the treatment works, the aqueduct that carries the water from Boonton to Jersey City and the storage facility in Jersey City at Summit Avenue (Reservoir Number 3) are all on New Jersey's Register of Historic Sites as well as the National Register of Historic Places. They are examples of the public works projects undertaken by the great urban centers at the turn of the 20th Century designed



*The Bleach Powder Sanitation Building (still standing today) at the Boonton Reservoir. Credit: Courtesy of Boonton Historical Society*

to ensure that the growing cities had a secure high-quality source of drinking water for their residents.

In 2014, the Jersey City Municipal Utility Authority initiated a project to install a new water supply pipeline that relies on gravity. The pipeline cost a total of \$5.76 million but promised to save \$375,000 a year in electricity costs. Hatch Mott MacDonald, United Water, and Scafar Contracting partnered to construct the pipeline and received partial funding from the NJ Environmental Infrastructure Trust.

Suez, formerly United Water, now oversees the treatment of the Boonton Reservoir in the Township of Parsippany, where the filtration plant, pump stations, and headquarters are located. On average, 50 million gallons of water a day are treated, which also includes water from the Split Rock Reservoir in Rockaway Township. The facility can treat up to 80 million gallons of water each day, enough water for an estimated 800,000 residents' daily use. From the treatment facilities, water is piped through one of two 26-mile pipelines and aqueducts, southeast through Essex County, the Meadowlands, and under the Passaic and Hackensack Rivers to Troy Street in Jersey City. From Troy Street, water is distributed to customers in urban Hudson County.

### History of Access to the Reservoir

The Boonton Reservoir has generally been off limits to the public, although the chain-link fence around its perimeter hasn't deterred everyone. Visitors have created their own access points by squeezing underneath the fence or by cutting holes through it.



*Caption: The Boonton Reservoir Dam today. Credit: Jack Morningstar*

In 1996, the Reservoir was opened to anglers through a permit system administered by Jersey City and regulated by the New Jersey Division of Fish, Game and Wildlife. Each year from April 1st to October 31st, the Reservoir was open to permitted fishermen from 7 AM to a half hour before dusk. Largemouth and smallmouth bass, perch, bluegills, trout and carp could be caught. Jersey City residents were sold permits for \$10, while non-residents sold \$20 permits with discounts for senior citizens and children under 18. In 2000 alone, Jersey City sold over 1,300 permits. To accommodate the fishermen, Jersey City authorized two access points with parking, including the east end of Monroe Street in Boonton for access to the North Shore and the main gate of the Reservoir property on Greenbank Road in Parsippany-Troy Hills for access to the East Shore.

Recognizing the recreational potential of the Reservoir in 2001, the MCPC, Town of Boonton, Township of Parsippany-Troy Hills, Rockaway River Watershed Cabinet, Friends of the Rockaway River, and City of Jersey City, in collaboration with the Conservation Design Forum and Cahill Associates, prepared a Master Plan for a reservoir trail. Though a comprehensive plan was proposed, the project never came to fruition. After September 11th and the heightened security concerns at the time, public access to the Reservoir was closed and the Jersey City fishing permit system was discontinued. However, this has not stopped people from illegally hiking, fishing, or camping on the property.



## Public Access to Reservoir Properties and Proposed Public Use

Public access to water supply reservoirs is not uncommon. Nearly all of the New Jersey's major reservoirs allow some form of recreational access. At Jersey City's other reservoir, Split Rock (located approximately 10 miles north of the Boonton Reservoir), fishing, boating and hiking are permitted. The table on page 15 outlines the various forms of public recreation allowed at reservoirs in New Jersey.

### **SPLIT ROCK RESERVOIR**

The Split Rock Reservoir is located about eight miles from the Boonton Reservoir and also supplies drinking water to Jersey City. Split Rock is a reserve source of water that supplies the Boonton Reservoir during times of drought and high demand. It was constructed shortly after the completion of the Boonton Reservoir and is connected to the Jersey City water supply by an aqueduct that runs between Rockaway and Boonton. One-thousand, five-hundred-acres of wilderness surround the 650-acre reservoir, which borders Rockaway Township and Kinnelon. Since 1996, the state government has held a conservation easement on nearly all the surrounding wilderness.

In 2003, Split Rock was opened for selected recreational activities. Fishing, boating, and hiking are permitted, though shoreline fishing is still not allowed. Similarly, small craft electric motor-boats, kayaks, and canoes are permitted but gas-powered motors are not. Twenty-five parking spots and a boat launch are situated near the southwest dam, which also accommodate hikers that use the 11-mile loop trail known as the Split Rock Trail. The trail travels through the 5,000 acres of Farny State Park and its watershed.

In 2015, the state purchased 1,500-acres of watershed buffer lands from Jersey City to provide permanent protection to the land that surrounds the city's Split Rock Reservoir. This preserve serves as a greenway connector that links the Wildcat Ridge Wildlife Management Area, Farny State Park, and Buck Mountain. Jersey City has retained the water rights to the reservoir, as well as ownership, use and maintenance of the dam. Water is treated at the Jersey City Water Treatment Plant in the Township of Parsippany.



*The existing access road on the east side of the Reservoir, to be incorporated into the trail loop. Credit: Jack Morningstar*

## Chapter 2: Trail Design

### **CHAPTER OVERVIEW**

- 7.7-mile meandering loop around Reservoir with scenic viewpoints for passive recreation.
- Walking, running, and other passive activities will be the only permitted uses; pets and any access to the Reservoir waterbody for fishing, swimming, or boating will be prohibited.
- 100% pervious trail designed to cause minimal disturbance to natural resources.
- 2-mile ADA-accessible portion of trail, funding permitting.
- Exact alignment and design of the trail subject to permitting requirements but all changes will adhere to the parameters outlined in the PMP.



Proposed public use at the Boonton Reservoir Trail will be limited to pedestrian access for passive recreation only. Passive recreational access consists of walking, hiking, cross-country skiing, photography, birding, and other low-impact uses. Trail users will be required to stay on the trail. Biking, pets, horseback riding, and all access to the waters of the Reservoir for boating, fishing, or swimming will not be permitted. These regulations will be strictly enforced by the MCPC.

### Permitted Activities at New Jersey Reservoirs

Facility	Hiking	Boating	Fishing	Hunting	Swimming	Camping	X-Country Skiing	Bicycles/ Mtn Bikes	Pets
Boonton Reservoir (Proposed)	Yes	No	No	No	No	No	Yes	Yes**	No
Manasquan	Yes	Yes*	Yes	Yes #	No	No	Yes	Yes	Yes
Round Valley	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spruce Run	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Merrill Creek	Yes	Yes*	Yes	Yes #	No	No	Yes	No	Yes
Monksville	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Newark Watershed	Yes	Yes #*	Yes #	Yes #	No	No	Yes #	No	Yes
Oradell / Lake Tappan	Yes	No	Yes #	No	No	No	No	No	No

\*Electric Motors Only

\*\* Allowable in lease but not a planned activity at this time

#By Permit

The allowed uses are limited to passive recreation and are explicitly stated in the Recreational Lease Agreement between MCPC and the Jersey City Council. Any change of use of the trail would require an amendment to the lease with approval from the Council.

### Proposed Trail Route

The trail route will provide a 7.7-mile meandering loop around the Reservoir. Designed for passive recreation, the trail will provide the opportunity to be immersed in nature and travel through a variety of woodland and wetland ecological communities. In the future, the loop could be connected with neighboring community amenities and regional trail systems.

Trail construction is proposed to be phased, to allow for public access to portions of the trail sooner and to spread the need for funding across several years. The development of the trail is broken down into four phases in this PMP. The order of the phases is proposed as outlined below but subject to change as permitting and final design details develop. Detailed mapping of each of the proposed phases can be found in the Appendix.



It is important to note that the proposed alignment and design of the trail is preliminary and is ultimately subject to engineering and permitting parameters. Any design changes will adhere to trail development best practices, as well as all requirements from New Jersey Department of Environmental Protection and all other entities responsible for oversight.

## TRAIL PHASES

### Phase I

**Eastern Trail  
Section**

### Phase II

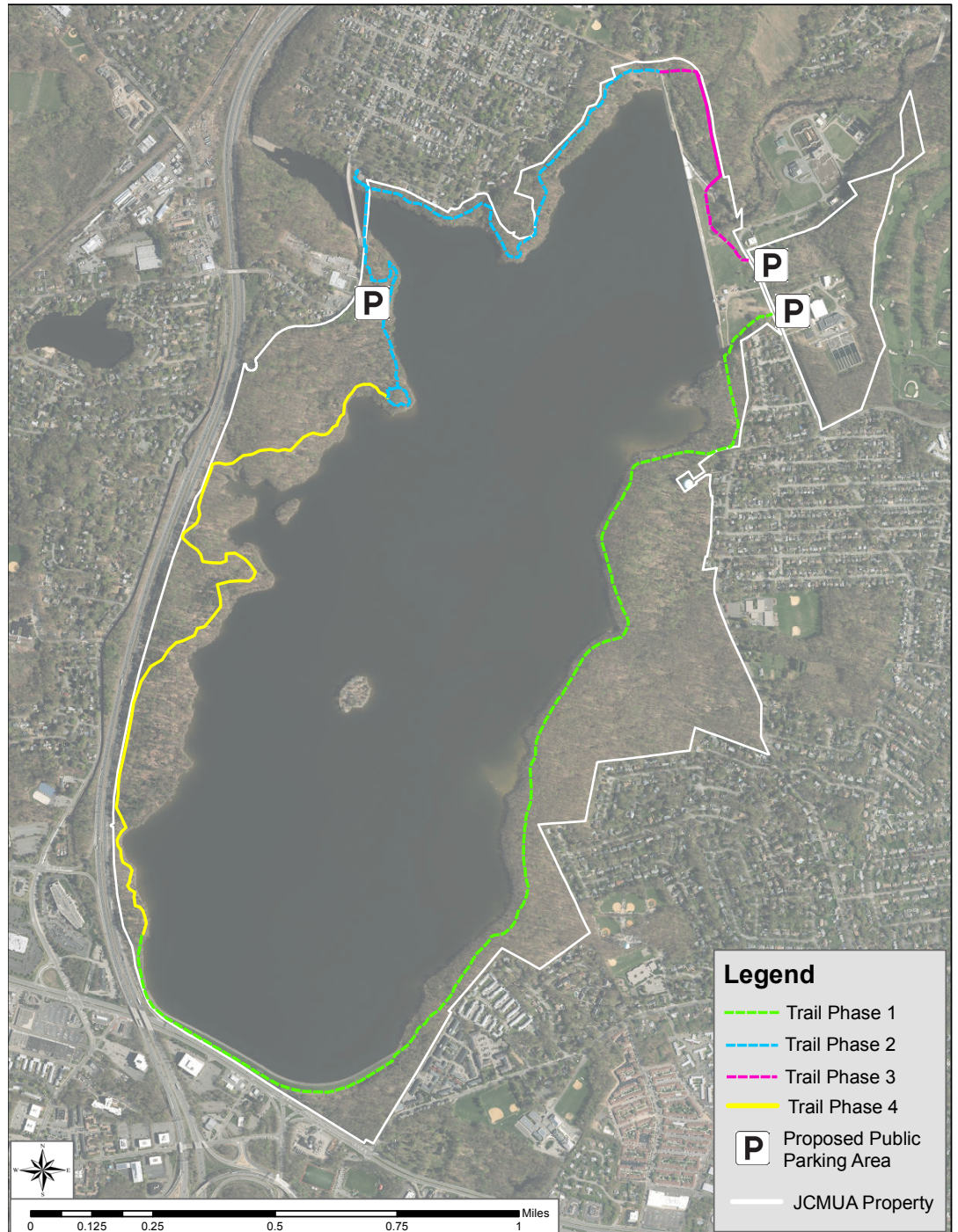
**Boonton Trail  
Section**

### Phase III

**Dam Trail  
Section**

### Phase IV

**Western  
Trail Section**



The proposed trail around the Boonton Reservoir, highlighting the potential phasing of construction. Maps of each phase of the trail can be found in the Appendix.

## **PHASE 1**

### **Eastern Trail Section**

**Approximately  
3.1 Miles**

## **Phase I: Eastern Trail Section** Approx. 3.1 miles



*Existing site conditions along the eastern and southern sides of the Reservoir.*

The Eastern trail section will begin at the Greenbank Road south parking area and will follow an existing access road along the eastern to southern edge of the Reservoir. Meandering along the eastern shore, the trail will offer views of woodland habitats, as well as views of the Reservoir. If funding can be secured, at the southern end of this trail section, visitors will have the opportunity for extended views over the earthen dike from an observation tower. With a wood exterior that fits in a woodland setting, the observation tower will offer framed views near and far of the dam and the Reservoir landscape.

## **PHASE 2**

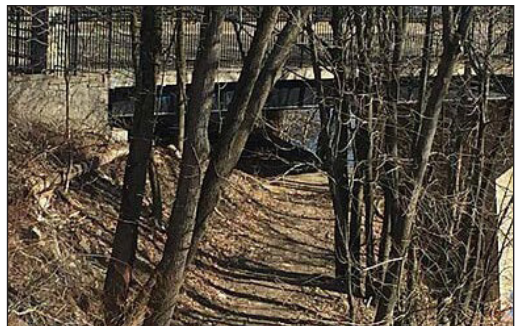
### **Boonton Trail Section**

**Approximately  
2 Miles**

## **Phase II: Boonton Trail Section** Approx. 2.0 Miles



The Boonton Trail section is accessed by the Parsippany Boulevard parking area and trailhead on Route 202 south of the existing Washington Street pedestrian bridge over the Rockaway River. This section of the route takes advantage of the pedestrian bridge that offers beautiful views of the Reservoir and surrounding landscape. Pedestrian-only access will be available from the north end of the Washington Street Bridge. A set of stairs will connect visitors from the bridge to the trail. This section of the trail runs from the northernmost scenic viewpoint on a small peninsula to the pump station to the east. The trail is designed as a double-track trail to the west of the pedestrian bridge and a single-track trail to the east of the bridge.



*Existing site conditions on the Boonton Trail section.*



### **PHASE 3**

#### **Dam Trail Section**

**Approximately  
.6 Miles**

### **Phase III: Dam Trail Section** **Approx. 0.6 miles**



The dam trail section connects to the Greenbank Road north parking area and provides the opportunity for trail visitors to see the impressive infrastructure of the dam. The construction of a new bridge will connect this portion of the trail (more information on the bridge can be found later in this section). Interpretive signage will tell the story of the dam construction and Jersey City's drinking water system.



*Existing site conditions on the Dam Trail section.*

### **PHASE 4**

#### **Western Trail Section**

**Approximately  
2 Miles**

### **Phase IV: Western Trail Section** **Approx. 2.0 miles**



*Existing site conditions on the Western Trail section.*

The Western section of the trail traverses a narrow strip of land between the Reservoir characterized by wetlands, woodlands, and wildlife habitat. The route of the western forest trail section is designed to avoid ecologically sensitive areas, preventing disturbance of heron foraging areas and potential Bald Eagle nesting areas. Where necessary, boardwalks and bridges will allow visitors to cross wetland areas while protecting the sensitive ecological communities on the site. This section of the trail will be single-track and will provide views of wildlife habitat from a bird blind on the western shore.



## Proposed Trail Design Standards

MCPC typically employs US Forest Service trail construction standards. MCPC also works with the New York-New Jersey Trail Conference, who has put forward the Primitive Footpath Trail Construction standards. These standards have been accepted by NJDEP for regulated areas such as wetlands and floodplains.

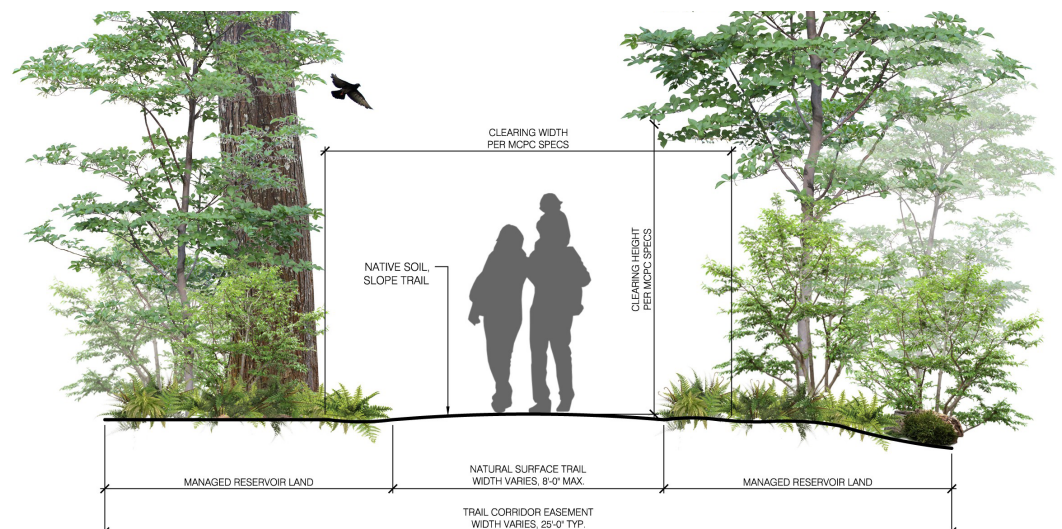
The Reservoir Trail will be sited within a trail corridor which, although variable, typically measures 25 feet wide. Within this corridor, trails will not exceed 8 feet in width per the Recreational Trail Lease Agreement and shall accommodate emergency ATV vehicles. MCPC typically removes vegetation within 24-36 inches on either side of a trail that will impinge on or droop over trails. In part this practice reduces the potential for contact with ticks, a significant public safety concern.

## Natural Surface Treatment

A low-impact, natural surface treatment is proposed for sections of the Reservoir Trail. Such construction will cause minimal disturbance to the existing landscape and provide a safe and navigable trail experience for users. Construction standards for these trail sections aim to mitigate any erosion or drainage issues due to compaction and displacement. The natural surface trails, as with all trail treatments, are sloped to allow water to gently flow downslope keeping trails dry and firm.



A Natural Surface Trail. Credit: Credit: Boyd Shearer / [CC BY-NC-SA 2.0](#)



## Improved Pervious Surfacing

Mainly occurring along Phase I of the Reservoir Trail, improved pervious surfacing will be constructed in sections of trail that have previously been surfaced. The Phase I trail largely follows an existing roadway access route through the site. A compacted stonedust surface course, final depth to be determined, will be installed over the existing

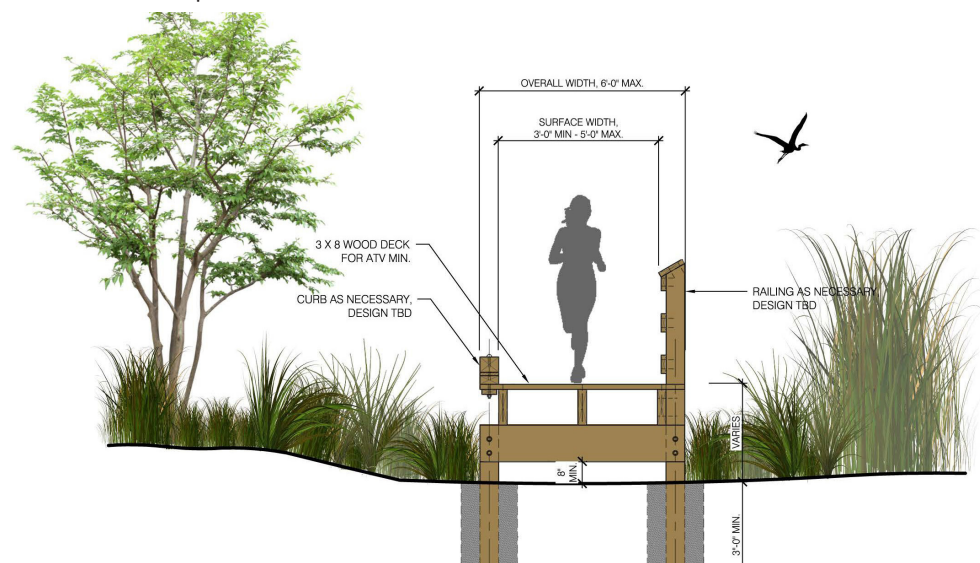


*An improved pervious surface. Credit: camknows / [CC BY-NC-SA 2.0](#)*

compacted base course in these sections. As with the natural surface trails, these trails are to be sloped to allow for proper drainage and maintenance. As necessary, sections of improved pervious surface trail may need to be raised to mitigate anticipated water levels (see discussion of Bascule gate below).

## Elevated Wood Boardwalks

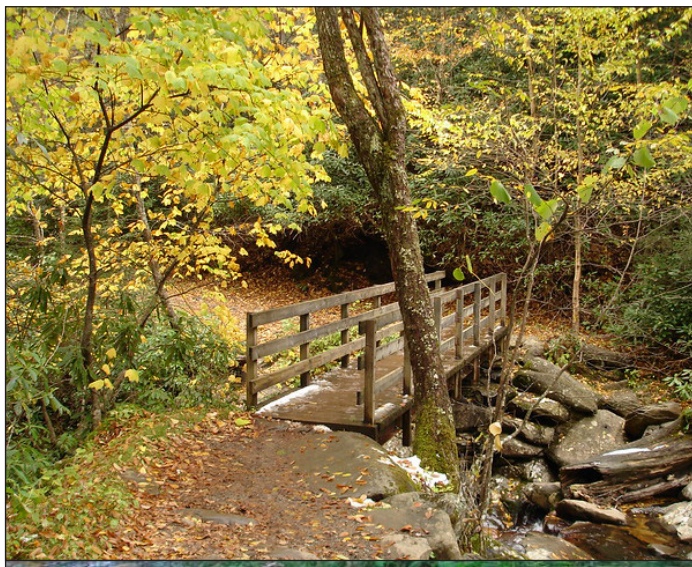
Mainly occurring along Phase IV of the Reservoir Trail, elevated wood boardwalks will be constructed in sections of trail that cross wetland areas. Design and construction details for each section of boardwalk may vary slightly to address wetland conditions at each location but will follow standards set forth by the US Forest Service. It is recommended that FSC certified wood be specified for all boardwalk construction. Boardwalks will allow for trail users to complete an uninterrupted trail loop, experience wetland habitat, and minimize impact to sensitive wetland areas.





## Bridges

Mainly occurring along Phase IV of the Reservoir Trail, wood bridges will be constructed



Wood trail bridge. Credit: talywil1 / [CC BY-NC-ND 2.0](#)

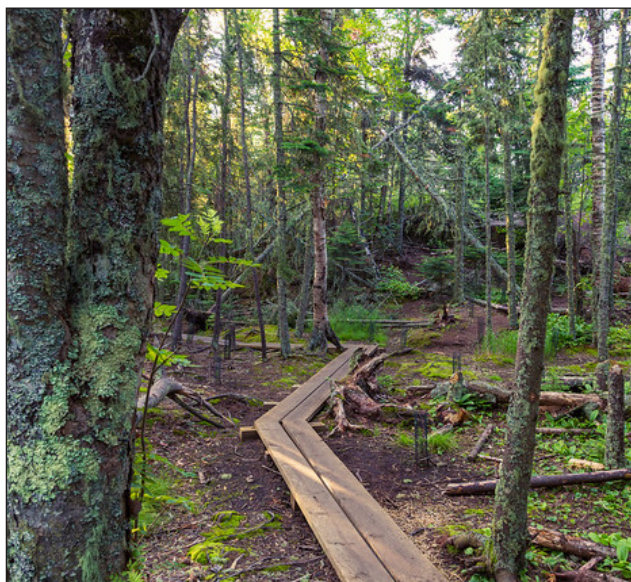
in sections of trail that cross waterways. Design and construction details for each bridge will vary as needed to address conditions at each crossing but will follow standards set forth by the US Forest Service. It is recommended that FSC certified wood be specified for all bridge construction. As with boardwalks, bridges will allow for trail users

to complete an uninterrupted trail loop, experience wetland habitat, and minimize impact to sensitive waterways.

## Puncheons

Mainly occurring along Phase II of the Reservoir Trail, puncheons will be constructed

as a low-impact solution for users to pass sections of trail that are seasonally wet or muddy. Wood sleepers, or sills, are spaced out along these seasonally wet sections and typically pinned in place. Wood planks set on top of the sleepers, allow water to pass under the stable walking surface. It is recommended that FSC certified wood be specified for all puncheon construction. This treatment not only provides trail users with dry, stable ground, but also minimizes disturbance to these sensitive areas.



Puncheons can help visitors traverse muddy sections of forest.

Credit: Tony Webster / [CC BY-SA 2.0](#)



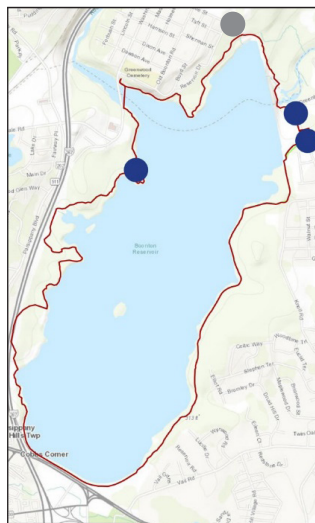
## ADA Accessibility

A portion of the Phase III section of the Reservoir Trail will be ADA accessible, pending funding availability (which is anticipated). ADA accessibility serves the important purpose of ensuring all potential users have an opportunity to enjoy the trail experience.



An ADA Accessible trail. Credit: vastateparksstaff / [CC BY 2.0](#)

In addition to users with disabilities, accessibility standards improve the overall trail experience and opens access to those with strollers, small children, and the elderly. Trail construction standards for this section will follow guidelines outlined in the ADA Standards for Accessible Design.



## Parking Areas and Trailheads

The trail is to be accessible via three parking areas located in Parsippany-Troy Hills Township and via the existing walking bridge in the Town of Boonton. A possible fourth parking area site has been identified if traffic conditions demand additional parking, that will help avoid on-street parking used as overflow parking. These areas will provide sufficient parking spaces for the level of visitation anticipated, based on experience at similar sites. Siting of the parking areas has been informed by discussions with Dam Safety experts at the NJDEP and the Office of Homeland Security. The parking areas will accommodate approximately 100 vehicles and have been strategically located so as not to conflict with the use and safety of the critical infrastructure on the property and to discourage street parking.

Parking areas will be secured with lockable gates and removable bollards. The bollards will be placed at the trailheads to prevent unlawful access, while allowing maintenance staff and emergency response personnel to access the trails with ATVs. Site access will

be permitted from sunrise to sunset per MCPC rules. Parking rules will be enforced by the MCPC in coordination with Morris County Park Police. The MCPC plans on using automated counters to gauge the number of visitors to the site, as it does at other MCPC park sites. The MCPC does not plan to charge a parking fee for the site.

Parking areas will be designed to minimize impact on the surrounding environment. Lots will be surfaced with gravel, a pervious material, and will follow best practice guidelines for stormwater management. Bioswales, like those used at Duke Farms (pictured below) and at the MCPC's Loantaka Brook Reservation will capture surface runoff and naturally filter pollution and silt. The bioswales, which will feature native plantings, also will provide habitat for birds, pollinators, and insects.

Parking areas will be ADA compliant. To ensure compliance with ADA guidelines



*Parking area with bioswale in Hillsborough Township, NJ. Credit: Duke Farm Foundation*

and stormwater best management practices, designated ADA spaces will be paved with pervious pavers or pervious asphalt. In addition, appropriate signage and line striping will be installed at these locations.

Not only do designed parking areas provide identifiable points of access to users and improve public safety, but they also serve as an information hub for visitors. Trailhead kiosks located at, or adjacent to, each parking area will feature trail maps, notable historical and ecological facts, trail rules and regulations, and safety and emergency information, to orient trail users as they arrive to the site. Information about trail apps, websites, and county contacts will be also posted. The number and design of kiosks will be subject to funding.

### Greenbank Drive Parking Areas

The proposed Greenbank Drive parking areas are directly northeast of the Reservoir on land that is typically level and void of wetlands. Each site is strategically located across the road from a trailhead with the Greenbank Drive North Parking Area sited across from the Phase III trailhead and the Greenbank Drive South Parking Area sited across from the Phase I trailhead. In addition, the Greenbank Drive South Parking Area will take advantage of the Jersey City Water Treatment Plant's existing driveway access.

The proposed parking areas will feature pervious gravel surfacing, new guardrails, bioswales on their western edge with native plantings, information kiosks, benches,





View of proposed Greenbank Drive North Parking Area.

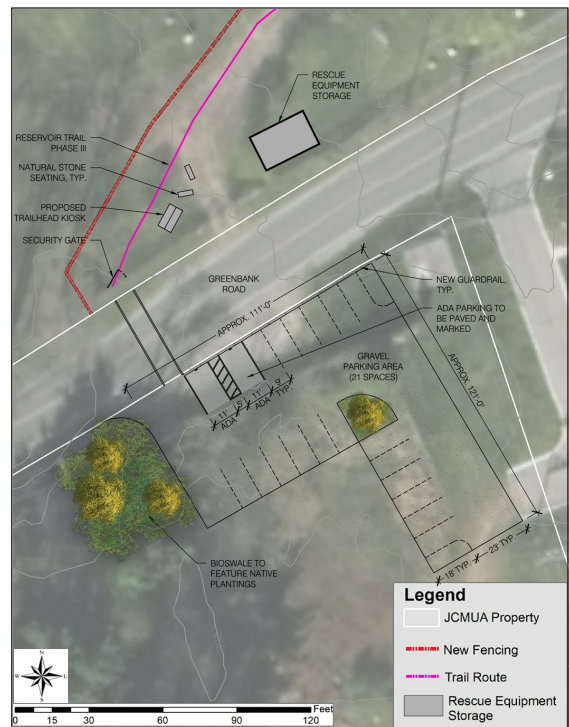
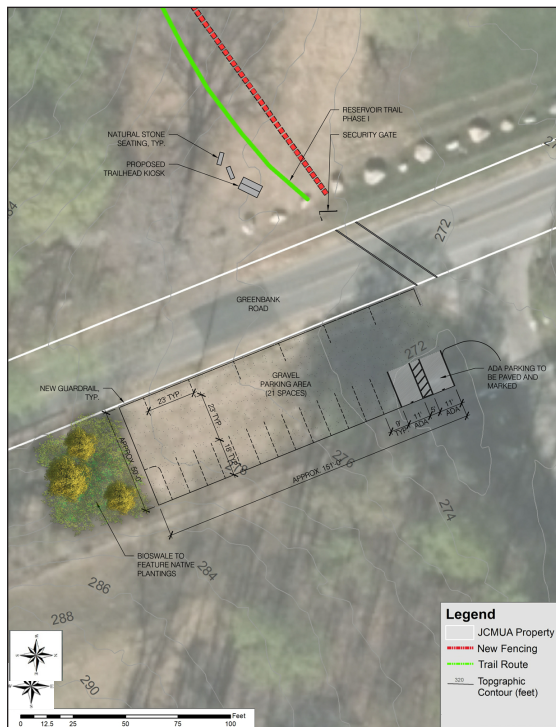


View of proposed Greenbank Drive South Parking Area.

Drive South Parking Area site will also need to be relocated to accommodate proposed parking.

waste/recycling receptacles, portable sanitary facilities, and bike racks. Each lot will accommodate approximately 21 parking spaces, two of which will be ADA accessible.

Although minimal, some adjustments to existing infrastructure at the two sites will be required for construction. At the Greenbank Drive North Parking Area, the site's existing gate will need to be pushed back from the roadway to accommodate the proposed parking area. An existing fire hydrant on the proposed Greenbank







### Washington Street Bridge Trailhead

A pedestrian only access point to the Reservoir Trail will be provided at the north end of the Washington Street Bridge. The bridge, which sits over the Rockaway River at its point of entry into the Reservoir, offers elevated views of the site. This trailhead will serve as a main access point for Lower Boonton residents connecting pedestrians to the proposed Parsippany Boulevard Parking Area and its associated trailhead (Phase II. Boonton Trail). Directional signage will be provided along the trail to guide users as they navigate to the main trail loop.



*Existing Washington Street Bridge connections.*

### Additional Boonton Access Point

Due to concerns raised about on street parking in Boonton neighborhoods, no parking or points of public access are proposed within Boonton, beyond the Washington Street Bridge trail head. Should that change in the future, an appropriate site has been identified at the northernmost corner of the Reservoir property, off Monroe Street. There is an existing gate and access road in that location, which had been previously used for public access when fishing was permitted at the Reservoir. Should the interest arise in the future, this site would be the ideal location of a fourth parking facility.

The exact design and amenities included at the Boonton parking facility may change, subject to access, permitting and funding. The general location and approximate size of the parking facility is not subject to change.

### Bridge at Rockaway River Crossing: A Modern Bridge and Historic Precedent

The full realization of the Reservoir Trail as an approximately 7.7 mile loop will require the construction of a 120' long (approx.) bridge spanning the Boonton Reservoir Dam's outflow structure. Such access will not only allow for ease of use by pedestrians, but also support future trail connections to Downtown Boonton, adjacent towns, and the region at large.



A review of the Boonton Historical Society archives establishes clear documentation of a through (or high) truss bridge that was once located at the outflow structure under the dam. A series of photos, dated to the Spring of 1936, detail the metal bridge structure from numerous views (See images below). These photos, along with any additional historic documentation that can be located, will guide the design of the new bridge structure. Due to the historic bridge precedent that has been established, the final bridge design will require review and approval by the State Historic Preservation Office (SHPO) prior to implementation.

Beyond historic precedent, trail accessibility and engineering requirements will need to be reflected in the new design. According to the Recreational Trail Lease Agreement, the trail shall be adequate for use by emergency ATVs. The required emergency access establishes parameters for the bridge design that will impact its loading capacity, overall width, railings/barriers, decking material, etc.

Additional design parameters will be necessitated by the bridge's siting. Situated at the dam outflow structure, the bridge will be subject to massive water volumes during periods of high water. Although intermittent, these high water periods require that not only is the bridge itself engineered to withstand such events, but its abutments must be as well. Abutments for the original through truss bridge are intact, but it remains to be understood if they are adequate for the new bridge construction. Following a complete engineering review and assessment, it will be determined if the existing abutments meet current design and code requirements. If required, the existing abutments will be re-engineered to address any deficiencies and the necessary approvals obtained from NJDEP.

In the event that a historically sensitive truss bridge proves too costly to construct, alternate designs will be considered that meet engineering requirements, design guidelines, and preservation standards.

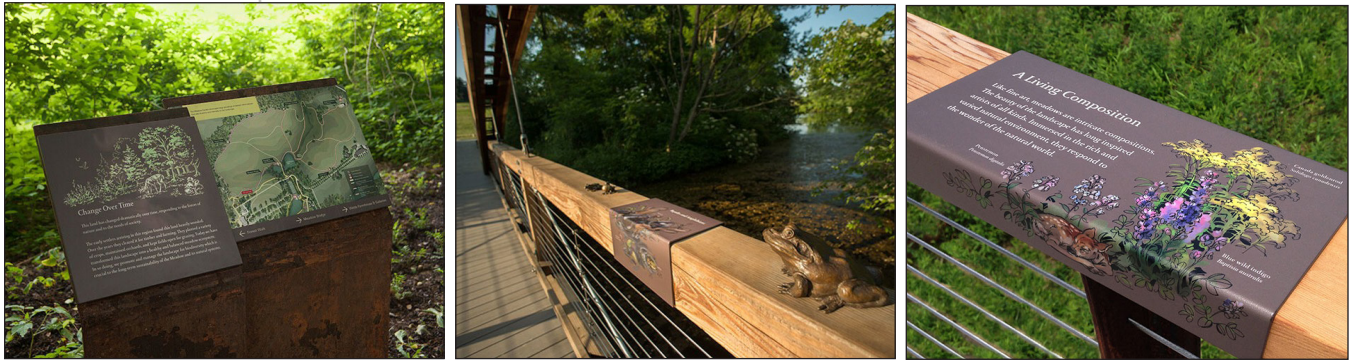


*Views of the historic bridge during high water (spring 1936). Credit: Courtesy of Boonton Historical Society*



## Trail Interpretation and Wayfinding

The Boonton Reservoir Trail provides the opportunity to share information and stories related to the history and ecology of the site and the region. The site offers layers of history including the legacy of Native American culture, Old Boonton, and the development of the Reservoir itself. The ecology of the site both historical and current is a



Interpretive signage at Longwood Gardens in Pennsylvania. Credit: Gecko Group

platform for education about natural systems and environmental stewardship. These stories will be communicated through signage and imagery but also through carefully selected materials and interpretive elements weaved through the trail amenities.



The trail's wayfinding system will help visitors easily identify their location on the site, plan and navigate their visit, and provide rules and regulations as well as safety and security information. The wayfinding elements will support emergency response efforts through providing reference points for incident location and for finding lost visitors, as well as guidance for determining the appropriate point of emergency access and the appropriate authority for response. Signage will include

universal symbols and graphics that helps communicate clearly to all including, those with limited reading abilities or limited understanding of the English language. The system incorporates trailhead kiosks, orientation maps, trail wayfinding markers, directional signage and accessible trail signage.



Corten wayfinding markers. Credit: Paul Burk Photography and Ayers Saint Gross (left) Credit: Communita Atelier (right)

### Proposed Water Quality Improvements

Stormwater improvement investments will be made on the property on at least 2-3 of the stormwater outflows identified in the Rippled Waters Engineering Stormwater Management Review (Appendix). These will likely be selected in conjunction with areas where trail crossings, such as bridges or puncheons, need to be installed. More information on the proposed water quality improvements can be found in the “Resource Management and Ecological Improvements” section of the PMP and in the Stormwater Management Review in the Appendix.

### Donor Acknowledgments

Portions of the funding for the planning and construction of the trail will come from philanthropic support. Amenities such as benches and trailhead kiosks may be named in honor of philanthropic supporters of the project.

### The Proposed Bascule Gate and Trail Siting

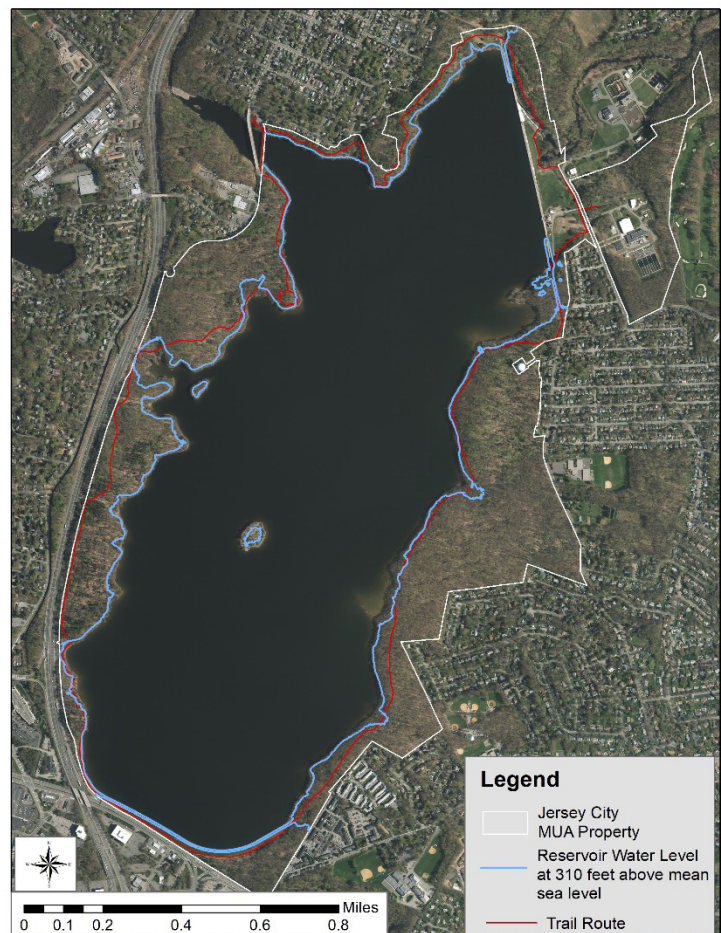
The current spillway atop the dam is at an elevation of 305.25 feet above mean sea level (msl). The surface elevation of the Reservoir varies with the seasons and individual precipitation or snow melt events. Prior to 1988 there were two crest or “Bascule” gates atop the spillway that controlled the level of the Reservoir. The JCMUA is planning on reinstalling the Bascule gates. Once reinstalled, the elevation of the top of the gates will be 307.5 msl, 2.25 feet above the current spillway. This will raise the surface elevation of water in the Reservoir, assuming upstream hydrologic conditions remain similar over the long term.

An increase in the surface elevation of the Reservoir will cause the water’s edge to encroach further into the surrounding land than current conditions. Thus, the trail system may need to be modified in the future, should the Bascule gates be installed, to adapt to a change in the range of Reservoir water levels that will occur. Modification of planned trail structures, designing and installing new structures, and/or re-routing the trail may be required in some areas. An increase in the range of water levels will also inundate parts of the Reservoir shoreline, which may cause wetlands to migrate inland and may have other ecological impacts.

An analysis of available data on Reservoir water levels was conducted to attempt to predict water levels that would be experienced after installation of the Bascule gates. The United States Geological Survey (USGS) maintains a monitoring station at the spillway to record water levels at the Reservoir. Data is available from 2010 to the present. This data provides useful information about the highest and seasonal water levels that have been experienced at the Reservoir, allowing for a reasonable projection of what will occur after reinstallation of the Bascule gate.

According to the USGS data, the highest Reservoir surface elevation experience without the Bascule gate in place was 309.5 msl, which is four (4.25) feet higher than the current spillway elevation (305.25 msl). As this elevation was experienced only once in the last 10 years, it would not be logical to use this elevation in planning the trail. Seasonal data are useful in terms of projecting maximum water levels that would be experienced, as these would be levels the trail and associated infrastructure would experience on a regular basis. Examining the USGS gage data, seasonal Reservoir levels regularly reach approximately 307 msl, which is 1.75 feet above the elevation of the spillway. Thus, because the top of the Bascule gate is planned to be at 307.5 msl, it is not unreasonable to anticipate that seasonal water levels will regularly reach an elevation exceeding 309 msl. To provide a margin of safety, it can probably be assumed that Reservoir water levels will reach 310 msl seasonally. This elevation extends significantly beyond the current shoreline in several areas surrounding the Reservoir, where drainage channels create subdued land elevations. A map showing the location of the 310-foot msl contour based on Light Detection and Ranging (LIDAR) data obtained through the New Jersey Highlands Council in relation to the location of the proposed trail is provided. The LIDAR data provides two-foot elevation contours, allowing for a rigorous analysis at the Reservoir.

There are some areas where the increased water level will interfere with the proposed trail routing. In those areas, consideration will be given to either rerouting the trail or developing alternative construction strategies (such as floating boardwalks) that would address inundation. As the trail route is finalized and more information about the bascule gate installation is finalized, these problem areas will be considered and addressed.



*The proposed trail route and projected water level increases in the Reservoir due to the installation of a Bascule gate. The trail route may need to be modified to reflect these changes*





*New fencing will keep trail users away from the Dam and other critical infrastructure. Credit: Jack Morningstar*

## Chapter 3: Security and Public Safety

### **CHAPTER OVERVIEW**

- New fencing will be installed to prevent trail users from accessing critical reservoir infrastructure and the Reservoir waterbody. Cameras will be installed in critical areas.
- The Parsippany-Troy Hills Police Department, the Boonton Police Department and the Morris County Park Police will coordinate law enforcement on the property.
- Wayfinding elements and call boxes will help facilitate communication in an emergency. The entire trail will be ATV-accessible for emergency response.

The Boonton Reservoir is the primary water source for Jersey City. Over 260,000 people who live in Jersey City rely on the Reservoir for their drinking water, as do the businesses and industries that make the city a vibrant economic hub. A reliable water supply is the life blood of any urban center and protecting it is paramount.

There are three security challenges that arise from allowing public access at the Boonton Reservoir site. The first, and most important, is to ensure that the water supply for the City of Jersey City and the treatment and delivery systems remain secure. The second involves the management of the site on a day-to-day basis to enforce the rules and regulations enacted to govern the behavior of visitors to the Reservoir and the activities that will be taking place at the site. The third element is public safety and first response to address any incidents that occur at the site. The safety and welfare of visitors and the ability to respond quickly and efficiently to injured, lost or injured hikers must be considered.

### Securing Infrastructure

The security measures in place on the Reservoir property are adequate for a site without public access. However, modifications to the site are necessary to accommodate the creation of a public trail. Currently, local law enforcement does not enter the site unless summoned by on-site security. Security is provided by the water system operator, Suez. There are a limited number of call boxes on the property. There are cameras on the gatehouses near the dam to monitor activity. The perimeter of the entire site is fenced with card access vehicle gates. There is additional barbed wire fencing in place near the dam and infrastructure.

The primary security measure will be the installation of new fencing. The trail will be following the perimeter of the Reservoir and trail users will be kept away from sensitive areas of the site. Wherever the trail comes close to critical infrastructure, adequate measures, generally in the form of new fencing, will be incorporated to exclude hikers who might stray from the trail. Primarily this will be the area surrounding the main dam and spillway. This is the working area of the Reservoir and there are pump stations and other facilities that must be secured. The spillway will be an off-limits area for public safety reasons. Access to the dike at the southern end of the Reservoir along Route 46 will be prohibited. Trail users will be prevented from climbing the dike to prevent any unwanted incidents.

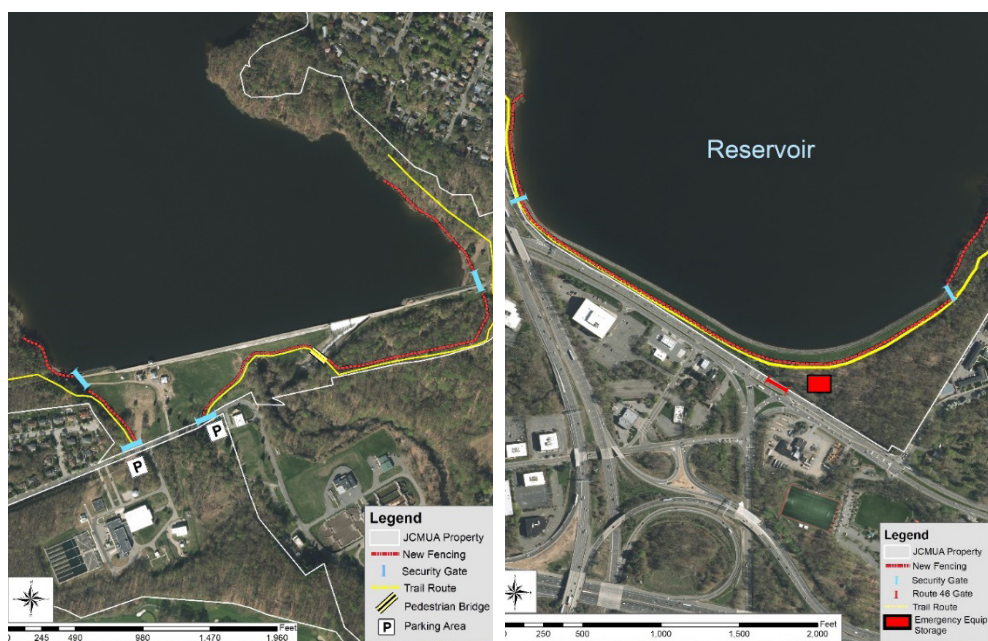
CCTV and/or trail cameras will be placed at all essential points. Footage from cameras can be accessed by law enforcement agencies for investigations as needed. Placing the entire site under visual surveillance is not practical nor is it recommended.

Jersey City, the JCMUA and Suez have an established security plan. They also have an



existing Emergency Action Plan and an Emergency Plant Operations Plan for the site.

These documents are in the process of being updated and will be completed without reflecting public access. Following these current updates there will be a need to include revisions to address public visitation of the site. Among the public access measures that will be addressed include the closure of the entire property during times of elevated Homeland Security risk. Provisions for incorporating the security measures set forth herein will be included in those updates. Acquisition and installation of additional secu-



*Proposed new fencing at the dam and dike sites.*

city cameras protecting the critical infrastructure will be an element of those updated plans.

### Law Enforcement

One of the advantages of opening the Boonton Reservoir property to the public will be the introduction of regular law enforcement patrols to the reservoir. A cooperative agreement between the City of Jersey City, the JCMUA, Parsippany-Troy Hills Township, The Town of Boonton, the MCPC, Morris County Park Police and Suez will be created to establish areas of responsibility and coordination.

Primary law enforcement responsibility will rest with Parsippany-Troy Hills Township as most of the Reservoir property is within that municipality. Parsippany has agreed that officers on patrol in the two patrol sections that cover the Reservoir property will, as part of their routine patrols, check the designated parking areas, public/ emergency access points, and portions of the trail passable by police SUV type vehicles on a routine and random basis. The township intends to purchase for police/ emergency service use, one or more ATV type vehicles, for patrol of the entire portion of the hiking path

located within Parsippany on a regular, but less frequent basis than regular patrols as described above. Priority will be placed on conducting these patrols at higher use hours such as early evenings and weekends.

In addition to adding the Reservoir to Parsippany's regular patrol schedule, the Township will assign Class II Special Police Officers to check all public and emergency access points on a nightly basis and will patrol all areas of the path accessible by police vehicle as described above. Particular attention will be given to ensuring no vehicles are left in the public parking area after closing hours, indicating that there may still be people on the property. If such vehicles are encountered, efforts will be made to contact the owner via DMV search and Police Headquarters will be advised to check CCTV feed for evidence of their presence within the Reservoir property. When called to the Reservoir property for an emergency or if it is believed visitors are still on the property after operating hours, ATV's will be used to respond to the emergency or search for any unauthorized person as needed.

The Boonton Police Department will patrol and respond to emergencies in the portion of the Reservoir property within their jurisdiction. It is anticipated that at least one storage site for off-road vehicles will be in Boonton and accessible to the Boonton first responders and police. The MC Park Police will also patrol and respond to emergencies within the Reservoir property. The MC Park Police will have access to all stored vehicles and will establish the Reservoir as a regular part of the departments daily patrol schedule. All three agencies may request additional law enforcement support from the Morris County Sheriff's Office, Morris County Prosecutor's Office, and other surrounding municipal police departments on an as needed basis through a pre-existing mutual aid agreement.

The MC Park Police do not have a set routine but respond as needed. The MC Park Police and the MCPC do a monthly report of activity in parks that will address violations. Incidents are tracked by park site, which will allow for the tracking and assessment of any violations experienced at the Boonton Trail site.

A protocol that clearly delineates responsibilities, patrol measures and response obligations for the law enforcement agencies involved in incident response and day-to-day monitoring of the site has been agreed upon. An outline of an agreement has been reached between Parsippany Police Department, Boonton Police Department and the MC Park Police.

The Town of Boonton and the Township of Parsippany-Troy Hills have agreed to pass ordinances to allow local law enforcement agencies to issue summonses for rules violations and set penalties. It is recommended that Jersey City approve an ordinance establishing fines for the Reservoir property that can be enforceable by the MC Park Police and the



Parsippany and Boonton Police Departments. Establishing fines for violations of rules that are more severe than the existing county fines (which are sometimes too low to be a true deterrent) will help prevent violations. Fines would be administered through the municipal court in the jurisdiction in which the violation occurred.

### **Public Safety and First Response**

Wayfinding elements will support emergency response efforts through providing reference points for location of incidents and for finding lost visitors, as well as guidance for determining the appropriate point of emergency access and the appropriate authority for response. Emergency reporting instructions, applicable rules, laws, and ordinances will be prominently posted at all public access points and parking areas. Solar-powered emergency call boxes may be placed at trail heads or at another determined interval and can be programmed to call the appropriate jurisdiction (Boonton or Parsippany Dispatch) based upon their location.

Emergency only entrances via locked gates will be available for Parsippany and Boonton Police Departments, MC Park Police, as well as any responding fire department or first aid service. The location of the reported incident or other triggers to a response will designate where the closest emergency ingress/egress point will be, the most easily accessed roadway for response and the agency that will be responding. Emergency entrances are proposed along Parsippany Boulevard, at Route 46 near the Reservoir dike as well as at Monroe Street and Reservoir Drive in Boonton. This would allow for access on both the Boonton and Parsippany sides of the Reservoir. Storage sheds for ATVs and other necessary equipment will allow responders to access the trails quickly, significantly cutting down on current response times.

The terrain surrounding the Reservoir and the length of the perimeter trail will present a response challenge in the event of a medical incident or emergency. While the trail along the eastern shoreline is accessible by SUV, the northern and western shoreline will be problematic. ATV's or other utility vehicles with off road capabilities will be necessary for both routine patrol of the more remote areas of the trail and for emergency response and transport of a sick or injured visitor. These vehicles will need to be equipped for search and rescue, first aid, patient transport and firefighting. They will need to be accessible for the entire length of the trail. They should also be staged at multiple locations. Equipment sheds to store the vehicles and related tools as well as to keep them charged will need to be placed in at least two places along the trail route.



*An ATV and stretcher rescue system will be used on the site. Credit: Morris County Parks Commission*



*The view from the Washington Street Bridge, which will be incorporated into the trail loop. Credit: Jack Morningstar*

## Chapter 4: Trail Management and Maintenance

### **CHAPTER OVERVIEW**

- Maintenance of the trail is the responsibility of the Morris County Park Commission. The MCPC has a dedicated staff and budget for maintenance and natural resource management.
- Park rules will be enforced by the Morris County Park Police, a division of the MCPC.
- Vegetation along the trail, trash pickup, and trail maintenance will all be conducted regularly by the MCPC, with potential for assistance from a “Friends Of” volunteer group.



### Who is the Morris County Park Commission?

The Boonton Reservoir Trail will be managed by the Morris County Park Commission (MCPC), an autonomous county agency with headquarters in Morris Township, New Jersey. The MCPC oversees over 20,132 acres of parkland, including formal parks, gardens, cultural sites and natural areas and 216 miles of recreational trails. It also has the authority to enter into agreements to manage trail easements on private properties and on land owned by other agencies. It has both an operating and capital budget to carry out its responsibilities. The Boonton Reservoir Trail would be managed using an approach similar to other conservation areas in the county park system.



**The Mission of the Morris County Park Commission is to develop and preserve a dynamic and unique system of diverse natural, cultural and historic resources, and to provide innovative education and recreation opportunities of regional value, while exercising environmental and fiscal responsibility.**



The MCPC maintains their own police force. The Morris County Park Police are a Division of the MCPC and are responsible for enforcing all park rules at all MCPC facilities. The Park Police have law enforcement powers within the territorial limits of the State of New Jersey (N.J. Statute Title 40:37-95.41).

For the MCPC and Park Police to assume management and policing responsibility for the Boonton Reservoir site, Jersey City, as the property owner, will need to pass an ordinance specific to the Reservoir site, adopting the MCPC park rules, site specific rules and delegating enforcement of the rules to the MCPC and Park Police.

### Rules and Regulations

Regulations will require visitors to stay on the designated trails and are only permitted to hike, walk, run or conduct other passive recreational activities during the designated operating hours of dawn until dusk. Dogs, biking, flying of drones, smoking, access to the Reservoir waterbody and other activities will not be permitted.

The MCPC also maintains formal practices and procedures that govern park activities that can impact natural and cultural features, including native plants, and wildlife. These include policies on wildlife management, collection of native seeds and plants, and scientific research on parkland.

The MCPC is committed to protecting wildlife and native habitats but maintains procedures for implementing control measures of individual animals or animal populations when animals are diseased, injured, present a public health or safety threat, or are damaging park infrastructure, cultural features, or the natural resources of a park or facility. This includes management of white tail deer, which is done on a site-specific basis, depending on the deer population, the impact it is having, and what measures are appropriate to safely and humanely contain its impact. The Appendix contains the MCPC Rules, Regulations and Wildlife/Habitat Interaction Policy.

### **Reservoir Property Maintenance**

The MCPC has considerable human resources to manage and maintain its parks, including three maintenance divisions whose crews are responsible for parks and trails, a trail crew, a dedicated eleven-person building and construction staff, and two full time and additional seasonal natural resources staff responsible for deer management, invasive plant removal, etc. The MCPC will rely on existing staff from its North Division stationed at the Tourne County Park, in nearby Denville and Boonton Township.

Parks in the MCPC system are opened at at sunrise and closed at sunset or have specific hours of operation. Maintenance crews attempt to open gates at parking areas and trailheads at or near these hours. Strict adherence is not possible, due to the need to visit several sites in the region each day and the possibility that staff are called to address an incident. Precise times at which gates will be opened and closed at the Reservoir Trail site will depend on the daily route taken by maintenance staff from the county's North Division. Staff, though, will closely adhere to the dawn-to-dusk protocol. The MCPC will not open parking area or trailhead gates during times of elevated Homeland Security risk.

The MCPC will maintain the trailhead parking areas. This includes any stormwater control structures installed to control runoff from these areas. The MCPC currently maintains similar stormwater mitigation structures at some of its parks. The primary maintenance activity involves removing non-native species from these areas, as native species that are either intentionally planted in them or that take naturally are part of the treatment process. The MCPC will plow parking areas during winter. It will periodically regrade the planned gravel lots or add additional aggregate, as necessary.



The MCPC will include the Reservoir property in their regular trash collection schedule. Trash receptacles will be located at each trailhead parking area and trash will be collected on a regular basis.

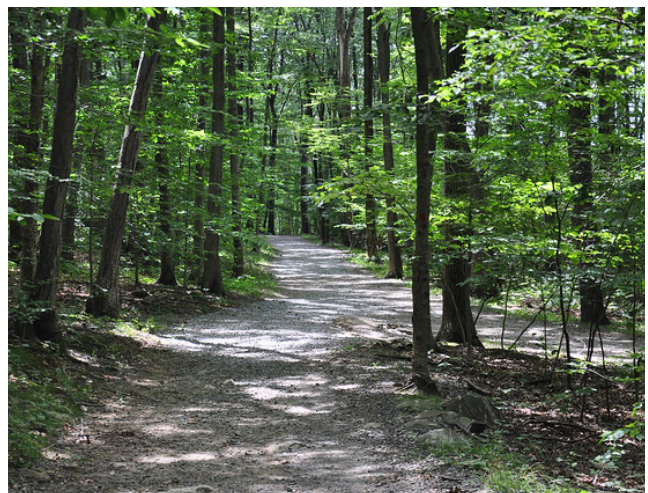
The MCPC will need to coordinate with Suez relative to the mowing of the grassed area at the base of the dike along Route 46 on the southern end of the Reservoir. The grass surface is an ideal hiking trail and Suez currently keeps it mowed to a suitable height.

### **Trail Maintenance**

Many of the MCPC's conservation areas and some of its parks contain "two-track hiking trails," like what is proposed for the Boonton Reservoir property. The MCPC currently manages similar trails at other water-supply sites, including the Clyde Potts Reservoir in Mendham and the West Morris Greenway, which traverses both the Southeast Morris MUA and Morris County MUA (Alamatong) well fields.

The width of trails and trail corridors in county conservation areas and for trails the MCPC manages on non-county land varies. For trails on private property, the trail corridor easement is designated as 25 feet wide; the trail itself is narrower, enough to accommodate hikers, bicyclists or equine users, depending on the site. The MCPC will typically remove vegetation within 24-36 inches on either side of the actual trail footprint, or vegetation that would impinge on or droop over trails. This practice is both for ensuring adequate passage of users and for reduction in the potential for contact with ticks, a significant public concern. The responsibility for trail maintenance work will depend on the maintenance levels and user impacts and may include the collaboration of another government or non-profit entity, contractor and/or volunteers, at no cost to Jersey City.

It may be necessary to periodically close sections of the trail for maintenance to damaged sections or where dangerous conditions exist. Trail sections will need periodic maintenance to address use, wash-outs, storm-downed trees and branches, and wear and tear on trail structures. MCPC maintenance staff will immediately address trail conditions it encounters during routine inspection that can be addressed and will note other conditions, so that they can be addressed with appropriate materials and equipment.



*Two-track natural area trail in Tourne, NJ. Credit: samenstelling / CC BY 2.0*

## Vegetation

The MCPC recognizes the value of trees on parkland for the aesthetics, shade, wildlife habitat, air quality, soil stabilization, and protection of water resources they provide. The MCPC replaces native trees that are removed from park land to mitigate the loss of the tree's aesthetic and environmental value. The MCPC policy for tree removal and replacement is based on the following criteria:

- Tree is dead, dying, diseased, damaged or injured and its location, condition, or deterioration constitutes a safety hazard.
- Tree location compromises the preservation and maintenance of buildings, structures, parking lots, utilities, or other resources.
- Tree location interferes with the construction of facilities and site development.
- Tree presents an immediate threat to public safety.
- Tree preservation is not economically feasible.
- Tree detracts from landscape design plans or does not fulfill plant collection objectives.
- Tree is considered an invasive species.
- Tree is infested with a pest or pathogen that threatens forest and landscape health.
- Removal of the tree is required to meet objectives outlined in an approved stewardship, forest management, or meadow management plan.

In addressing threats to trails and trails users posed by trees, consisting of trees in danger of falling, dangerous tree limbs, and dead trees that threaten the trail corridor, the current general operating procedure involves dropping in place or removing trees that are within 40 feet of the trail that pose an imminent threat. At this time it is expected that the removal of ash trees will become a priority as the Emerald Ash Borer continues to emerge in Morris County. The MCPC's Natural Resources staff will GPS inventory ash trees within 60-feet of infrastructure, parking areas and trailheads and provide Jersey City with mapping and an inventory count.

## Trash Removal

Maintenance crews will periodically inspect the condition of the trail and remove any trash they encounter on site. Based on their experience at other sites, the MCPC does not expect user trash to be a significant problem along the Reservoir trail, as users tend to remove trash from trails on their own, either because of their outdoor ethic or due to peer pressure.

### Community Engagement

The MCPC may establish a communication portal to allow the public to inform it of any significant maintenance needs and suggestions, or rely on routine communication, such as calls to a posted phone number and e-mails. The MCPC and partners will also investigate the potential for establishing a “Friends Of” type of volunteer group to organize volunteer help to monitor, clean, and maintain the trail on a periodic basis.





*A wetland area on the Reservoir site.*

## Chapter 5: Existing Conditions of the Reservoir Site

### **CHAPTER OVERVIEW**

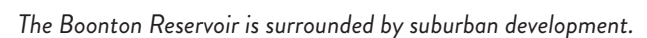
- The Boonton Reservoir is part of the Rockaway River Watershed, which is ranked by the Highlands Council as a high-quality watershed based on land use and habitat quality.
- The Rockaway River, the primary source of water in the Reservoir, is considered “generally good and suitable for most purposes with proper treatment.”
- Stormwater run-off is an important water quality concern for the Reservoir. There are several natural and man-made stormwater drainages into the Reservoir.
- Invasive species pose a challenge to forest health, which is exacerbated by large populations of white-tailed deer on the property.
- Several Federal and State Threatened and Endangered species may be present on the site, including Bog Turtle, Bald Eagle, and Wood Thrush.



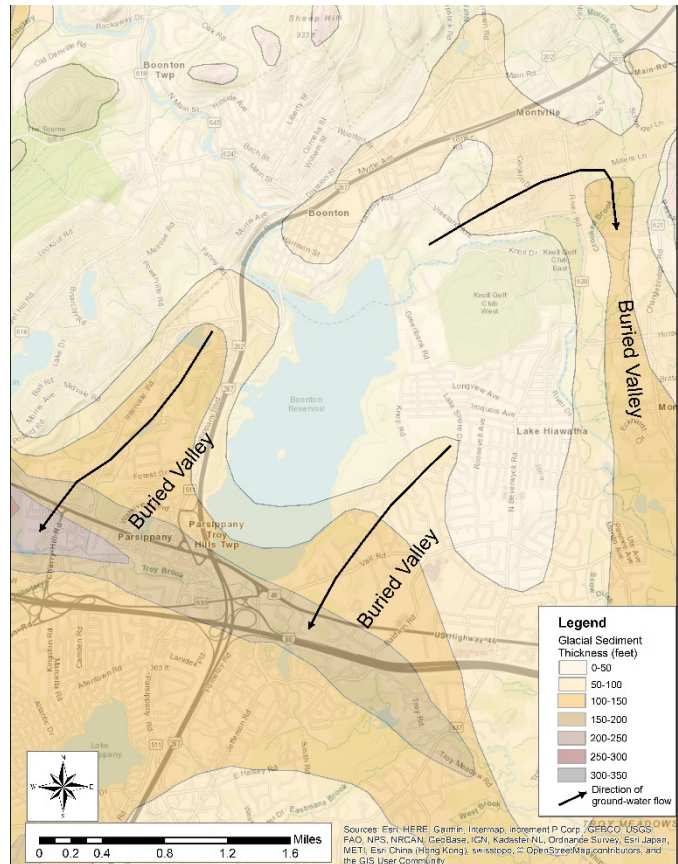
The climate of the Piedmont can be described as humid continental, characterized by cold winters, and hot summers. Rainfall averages about 48 inches per year. The region is dominated by mixed oak forest on well-drained upland sites over sandstone, shale, diabase, and basalt (lava rock) ridges. Canadian Hemlock and mixed hardwood forests are found in moister valleys, ravines, and on steep north-facing ridges. Sugar maple-mixed hardwood forests tend to dominate more fertile areas with deep well-drained soils.

The Upper Rockaway Watershed is underlain for the most

The eastern side of the Reservoir overlies the rocks of the Newark Basin, which consist primarily of sedimentary rocks such as conglomerate, sandstone, siltstone and shale. The Rockaway Valley above the Reservoir is overlain by glacial deposits laid down during both the advance and retreat of what is known as the Wisconsin Glaciation, the last



ice-sheet advance over northern New Jersey and retreat from the area approximately 7,000 years ago. Thick glacial sand and gravel deposits occupy the river valley and drape the landscape. These provide significant storage for ground water that discharges gradually and steadily to the river, providing more consistent flow characteristics than a valley that would lack such sediments themselves. This ground-water storage constitutes a reservoir, helping to ensure flow in the river on a consistent basis, while supplying significant amounts of ground-water supply to upstream communities.



*The glacial history of the region provides significant groundwater storage.*

The buried glacial valleys underlying the Reservoir allow ground water to flow to both the south and east. The thickness of these glacial sediments ranges from less than 50 feet in the northern part of the Reservoir to as much as 150 feet near Route 46 at the southern dike. They are the reason bedrock is not exposed at the surface on Reservoir property. The glacial deposits in the area of the Reservoir tend to be sandy, storing and transmitting significant volumes of ground water. Thus, ground-water flow from the flanks and perhaps bottom of the Reservoir may contribute to its volume as well.

### The Rockaway River Watershed

The Boonton Reservoir relies principally on the Rockaway River for replenishment. The Upper Rockaway above the Reservoir drains an area of 119 square miles in the New Jersey Highlands. Water quality in the Reservoir is directly impacted by the conditions within the Upper Rockaway River watershed. Land use in the region varies from dense forest to suburb to urbanized areas and includes a significant number of lakes and ponds.

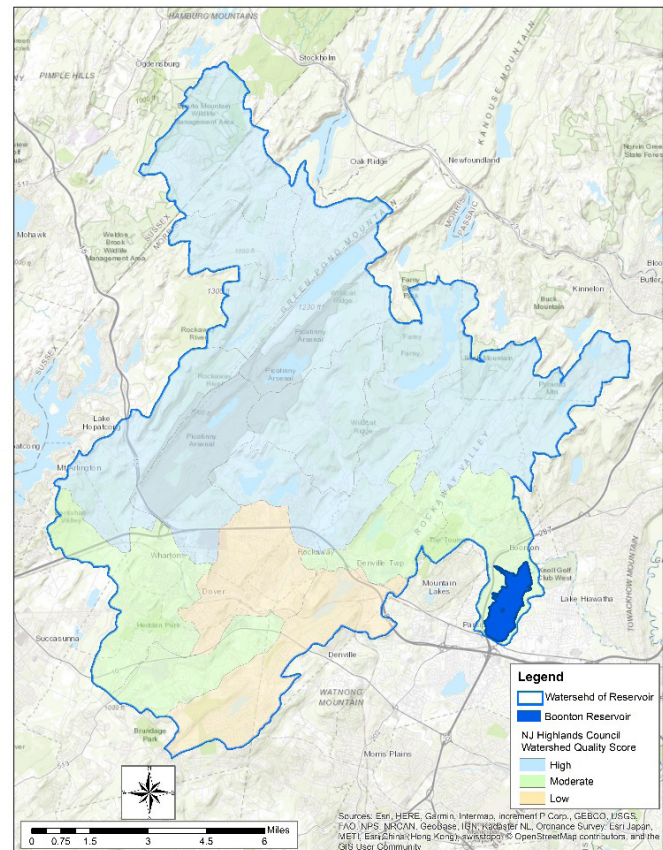


Urban and suburban development and the presence of other surface-water bodies in the watershed has had some effect on water quality. The watershed also includes a significant amount of permanently protected open space, much of this in intact forest, a condition that helps protect water quality and sustain stream flow. Strict land-use regulations imposed in 2004 by the New Jersey Highlands Water Protection and Planning Act has helped to limit the number of potential contaminant inputs to the watershed, providing an additional layer of protection to future water quality.

As part of its broader assessment of environmental conditions in the New Jersey Highlands Region, the New Jersey Highlands Council reviewed scientific literature to determine what factors lend to the overall quality of a watershed. The bulk of the Upper Rockaway watershed features low intensity development and large swaths of densely forested protected land. Watersheds with a high percentage of forest typically correlate with good water quality, due to the lack of contaminants emanating from land in its natural condition. Over time, a significant investment has been made in public land acquisition and protection specifically for the purpose of retaining the integrity of this portion of the watershed. This encompasses most of the major tributaries of the river as well as the Rockaway River itself.

High levels of groundwater recharge natural filtration provided by forests and wetlands and the absence of conditions that contribute to non-point source pollution provide for much higher watershed values and result in higher water quality. The degree to which water in a watershed can provide habitat for species sensitive to changes in water quality is another valuable indicator of watershed quality. Greater species diversity is a sign of high quality.

The Highlands Council evaluated the percentage of developed land, habitat quality and percent of



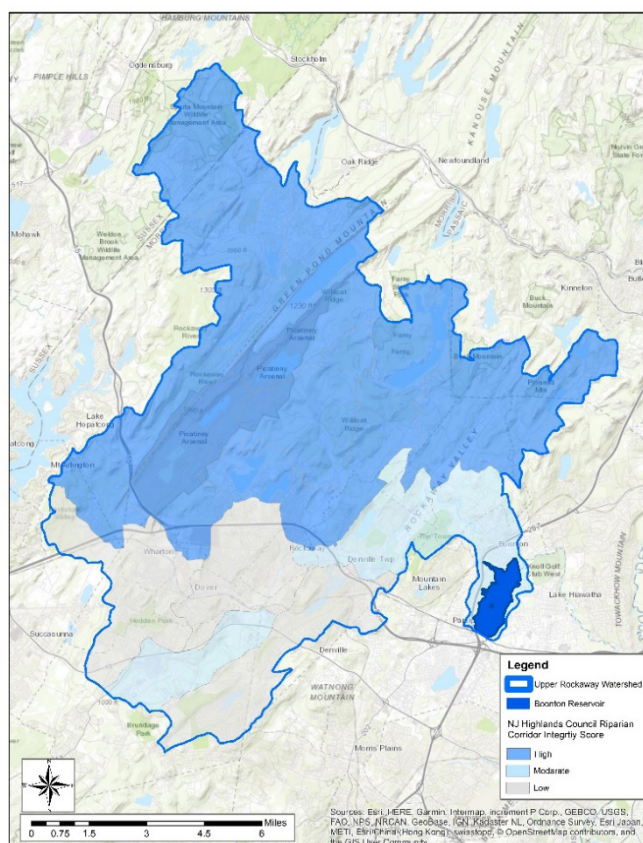
*The New Jersey Highlands Council's Watershed Quality Ranking for the Rockaway Watershed*

forest cover to arrive at a ranking for watershed quality, using the terms Low, Medium and High for each of the 16 sub-watersheds in the Highlands. Of the 16 HUC14 sub-watersheds in the Upper Rockaway above the Reservoir, 10 attained a High score, 4 a Medium score, and 2 a Low score, suggesting that the Highlands Council characterizes the watershed contributing to the Reservoir of generally high quality overall.

Another important characteristic assessed by the Highlands Council is what it refers to as “Riparian (relating to the banks of a stream) Area Integrity,” which it describes as a watershed’s capacity to protect water quality and its ecological viability based on the integrity of its stream corridors. Critical factors in this assessment include the ability of the watershed to attenuate nutrients; its ability to filter sediments and prevent them from entering the environment; stream bank stability; wildlife habitat; and the ability to store storm water and flood water.

The Highlands Council relied on land use data from the New Jersey Department of Environmental Protection (NJDEP) and information on roads from the New Jersey Department of Transportation as surrogates for the factors contributing to erodibility of stream banks and therefore a measure of Riparian Area Integrity. Specifically, it assessed GIS data depicting the amount of agricultural land use, number of road crossings per mile of stream, natural vegetation, quality of wetlands and endangered species habitat to arrive at scores for each sub-watershed. As with the Watershed Quality indicator, overall the majority (9) of the sub-watersheds within the larger Upper Rockaway Watershed achieved High Riparian Corridor Integrity ranking.

The Reservoir’s watershed sees some of the highest average rainfall rates in the state.



*The New Jersey Highlands Council’s Riparian Corridor Integrity Score*

The average annual precipitation in the Rockaway River Watershed is approximately 50 inches per year (USGS 1991). Precipitation generally falls uniformly throughout the year with July being the wettest month. The ample rainfall in the Highlands and its remote location explain why New Jersey's major urban centers established several major water-supply reservoirs within the region. The combination of reliable precipitation, favorable geology and forested land use have ensured adequate year-round levels of streamflow to supply these critical sources of drinking water.

### The Reservoir

The Reservoir is impounded by what is known as a cyclopean (constructed without mortar using large blocks of stone) masonry dam with earthen wings. This dam is 3,600-foot long and 105 feet high. It was designed to block the flow of the Rockaway River. A 2,600-foot-long earthen embankment contains the water in storage at the Reservoir's southern end just north of Route 46. A private water company, Suez North America, currently operates the Reservoir and its facilities under an agreement with the Jersey City Municipal Utilities Authority.

The Reservoir is over 11,000 feet (2.1 miles) long, and 3,800 feet (0.7 miles) wide at its widest point in the south and covers approximately 700 acres. It is designed to store a maximum of 7.6 billion gallons of water under present conditions. Recorded Reservoir storage has ranged from a maximum of 8.5 billion gallons in May 1998 to a minimum of 1.445 billion gallons in January 1981. The usable volume of the Reservoir is approximately 7.3 billion gallons. The design of the dam provides for a continuous minimal flow in the lower Rockaway River downstream of the Reservoir.

The current spillway atop the dam is at an elevation of 305.25 feet above mean sea level (msl). The surface elevation of the Reservoir varies with the seasons and individual precipitation or snow melt events.

### Reservoir Water Quality

The primary source of surface-water discharge to the Reservoir is the Rockaway River, as described above. Thus, the quality of water in the Reservoir is highly impacted by conditions in the Rockaway. According to the U.S. Geological Survey-Water Resources Division, the quality of the Rockaway River from a chemical standpoint is, "generally good and suitable for most purposes with proper treatment" (USGS-WRD WRI 91-4169, 1993) The river also supports a healthy and well-balanced macro invertebrate population, another indicator of its overall acceptable quality. There are no major sewage treatment plants or surface discharges in the Upper Rockaway watershed. This eliminates the nutrient and chemical loads attributable to treated effluent as a concern.

Water quality in the Rockaway River changes between base flow conditions (where the water in the river is attributable entirely to discharge from ground water) and storm flow conditions, when stream flow consists of both base flow from ground water and



surface runoff. Stormwater runoff brings about dilution, so constituents such as alkalinity, calcium, and chloride, are found in lower concentrations during storm events. But storm flow also contributes more runoff from urban areas, increasing the levels of trace minerals such as aluminum, beryllium, copper and lead in the river, as well as organic carbon, detergents, sodium, and potassium. Changes in the quality of the water entering the Reservoir can have an impact on the types and levels of treatment needed at the filtration plant and can have biological impacts. For example, the NJDEP's list of Water Quality Limited Waters, or "303(d) List," published under requirements of the Federal Clean Water Act, in 2012 listed the chemicals Chlordane, DDT and PCB as being found in the tissue of fish from the Reservoir. This potential justifies a fishing ban for the Reservoir pending additional study of fish in the Rockaway River and Reservoir. Despite these conditions, the concentration of all trace elements in the river - except for Manganese, which primarily is of concern relative to staining of plumbing fixtures - under all conditions are below U.S. Environmental Protection Agency (US EPA) and NJDEP Maximum Contaminant Levels. (mcl).

In evaluating potential impacts to the quality of the water in the Reservoir, stormwater runoff and natural streamflow from adjoining areas needs to be considered. The Reservoir is surrounded by mixed land use, much of which consists of roads and developed areas. The road system and intensity of development is greater along the western side of the Reservoir, but runoff on the eastern side drains developed areas as well.

The National Water Quality Inventory Report to Congress (US EPA, 1998) points out that a significant volume of research proves that stormwater runoff from developed areas is a significant source of impairment in rivers and lakes, affecting their water quality, habitat and biological value, and aesthetic appearance. Contaminants associated with runoff from roads and other infrastructure vary, depending on the nature of the development and intensity of use, but generally consist of the following:

- ~ Solids, in the form of sediments to which contaminants attached and debris.
- ~ Oxygen-demanding substances, which lower the oxygen content of water bodies.
- ~ Nitrogen and phosphorus, which promote growth of algae.
- ~ Pathogens.
- ~ Petroleum hydrocarbons and other chemicals associated with cars and trucks (e.g. antifreeze).
- ~ Metals, including toxic metals.
- ~ Synthetic organics, including herbicides, fungicides and pesticides associated with landscaping.

The potential impact to water bodies receiving stormwater flow from developed areas can vary, depending on the relative volume of runoff, size and quality of the receiving water body, and degree of development of the source of the storm water runoff. Impacts can range from short-term changes in water quality and aquatic habitat during and after storm events to long-term impacts brought about by ongoing input from contaminant sources.

Reconnaissance of the areas surrounding the Reservoir identified a significant number of stormwater outlets and natural stream channels draining the surrounding land. Detailed information on these drainages can be found in the Stormwater Management Review prepared by Rippled Waters Engineering, LLC.

Of greatest concern from the standpoint of physical, chemical and/or biological impacts to the Reservoir are the stormwater outlets along the western edge of the property in both Parsippany and Boonton. Five (5) of these have been identified along the western boundary of the property, three (3) of which drain runoff from Interstate Route 287. The other two outlets drain locally developed areas west of the Reservoir, including the Intervale Road/Parsippany Boulevard mixed residential commercial area in Parsippany and the residential area known as “The Flats” in Boonton. In addition to any concern over the quality of storm water emanating from these outfalls, several need physical repair.

The contributing watershed areas of these stormwater outlets was mapped to determine the land use they drain. This analysis shows that over 90% of the areas contributing to the stormwater outlets on the western side of the Reservoir drain developed areas, consisting



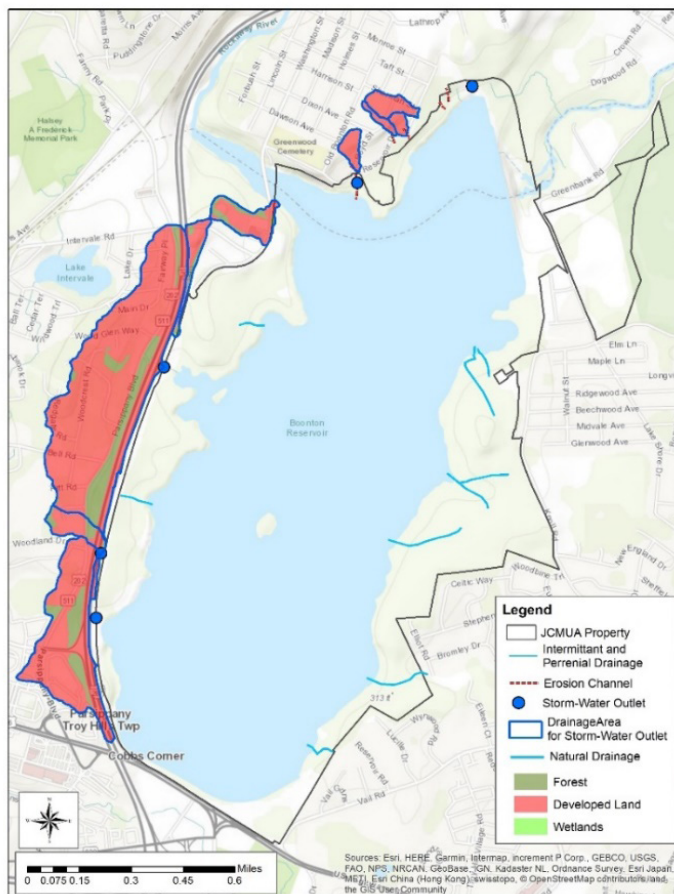
*Natural drainage in the forest east of the Reservoir. Left-to-right: Runoff across access road; runoff from neighboring development; vegetated stream corridor.*

of a mix of residential and commercial development, and include Interstate Route 287.

In addition to the stormwater outlets, areas immediately downstream of the outlets and other areas along the western shore of the Reservoir exhibit erosion attributable to runoff. These run the risk of sending sediment to the Reservoir.

East of the Reservoir, five (5) distinct drainage ways in the form of flowing streams and intermittent drainage channels were observed to cross the access road that will host the trail. These drain the forest itself, as well as parts of the residential areas in Parsippany to the east of and at the edge of JCMUA property.

In general, these drainage ways are vegetated and not highly eroded, although some local exposed areas are visible that point to some degree of erosion.



Map depicting the various stormwater outlets and natural stream channels draining the surrounding land.

## Water Quality Monitoring

Suez currently monitors water quality on the Reservoir. More information is needed to determine whether supplementary water quality monitoring would be a beneficial addition to the existing monitoring regime. Project partners will work with experts to determine whether additions to the existing water quality testing regime may be feasible and useful.

## Woodlands

An extensive ecological evaluation of the Reservoir property was prepared by Amy S. Greene Environmental Consultants as a component of this PMP. The full results of



their evaluation can be found in the Appendices.

The land surrounding the Reservoir is mostly forested, with trees of different ages on gentle slopes underlain by well-drained soils. The upper layer or canopy covers between 60 and 80 percent of the forested areas. Most trees measure between 10 and 20 inches in diameter at breast height (dbh), with some trees as much as 35 inches (dbh).

A rich variety of trees are found in the upland forests on the site. Tree species that dominate the canopy, or upper layer include bitternut hickory, red maple, sugar maple, northern red oak, northern white oak, black oak, American beech, tulip tree, white ash, eastern white pine, and sweet birch. Non-native Norway maple is common on the western property boundary. A limited amount of forest can be classified as mixed forest deciduous/coniferous forest, primarily consisting of white pine interspersed with native deciduous trees. These stands of pine, which are sheltered and often contain large trees, are particularly important for buffering the bald eagle nesting site found on the property.

Beneath the leafy upper canopy is the lower forest layer or subcanopy, dominated by American hornbeam, sassafras, black cherry, Japanese barberry, and multiflora rose; the latter two species are non-native. Much of the understory is open and contains non-native shrubs such as Japanese barberry and multiflora rose. Browsing by white tail deer appears to have eliminated much of the understory, allowing non-native invasive plants to establish themselves in the forest. This conclusion is further supported by the fact that young saplings of maple, oak and tulip poplar are not commonly found. The forest floor is dominated by non-native Japanese stilt grass, as well as native Pennsylvania sedge, wood asters, hawkweeds, striped prince's pine or wintergreen, and white snakeroot (a native member of the aster family).

Some parts of the forest that were subject to more recent disturbance, such as blowdowns, disease, and clearing in past



Top: Jack-in-the-pulpit. Credit: Keith T. Robinson / [CC BY-NC-ND 2.0](#)

Bottom: White snakeroot. BlueRidgeKitties / [CC BY-NC-SA 2.0](#)

decades, are dominated by pioneer tree species such as black walnut, black cherry, and sassafras. Non-native species including black locust, Norway maple and tree-of-heaven also occur in these forests. These disturbed areas also tend to have a ground cover with both native and non-native plants due to the high light penetration where upper canopy is missing. Species that are not sought by deer, such as Japanese stilt grass, white snakeroot, smartweed, lady's thumb, garlic mustard, and jack-in-the-pulpit dominate these areas.

Common non-native shrub and vine species found in the forest include dense stands of Japanese barberry, privet, honeysuckles, fox grape, and wineberry. Vines found on the site include the non-native oriental bittersweet and native Virginia creeper and poison ivy. Highly invasive mile-a-minute vine was found in at least one location. This invasive plant can be particularly aggressive and is likely an early candidate for eradication in any forest restoration efforts at the site.

A few areas of what can be characterized as “old field” are found along in ecotonal “edge” areas including forest borders, rocky shorelines, and semi-maintained locations onsite. These areas contain a mix of native and non-native species. Aggressive, non-native mugwort is common along disturbed shorelines, forest edges, building edges and other disturbed areas. Other common successional species observed include non-native Autumn olive, non-native spotted knapweed, dogbane, goldenrods (rough goldenrod, Canada goldenrod), and sweet goldenrod, common milkweed, white snakeroot, late-flowering boneset, daisy fleabane, and Canada thistle. Vines, including poison ivy, Virginia creeper, wild strawberry, Japanese honeysuckle and common cinquefoil.



*Herbaceous wetland under forest canopy on western shore of Reservoir. Credit: Harry Strano*



*Emergent wetland with various sedges along shore of Reservoir. Credit: Harry Strano*



*Forested wetland dominated by red maple on eastern shore of Reservoir. Credit: Harry Strano*



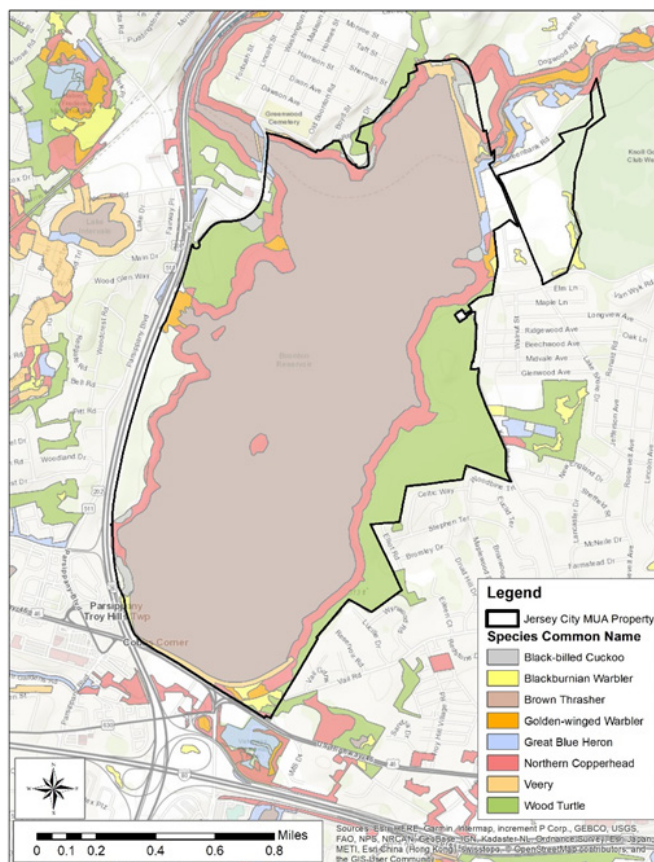
## Wetlands

According to the U.S. EPA, wetlands include areas where the soil is covered by water, or where water is present at or near the surface all or nearly all year. Wetlands are characterized by hydrophytic (moisture loving) plants, unique (often gray or dark) soils, and evidence of consistent water presence (saturated soil, standing water, flow marks, high water table). Wetlands are extremely important as wildlife habitat, for flood storage and as filtration of sediments and pollutants. As a result, wetlands are protected and regulated by state and federal governments and the trail development will avoid wetland impacts to the greatest extent allowable.

Wetlands of various types are found throughout the Reservoir property. Emergent wetlands are dominated by herbaceous plants such as sedges, cattail, nettle; and contain small amounts of shrubs such as dogwoods or highbush blueberry. Some emergent wetlands found on the site are saturated in spring but may dry out by mid- or late summer. In some locations, the emergent wetlands are fed by groundwater or exist along the

Reservoir shoreline and stay saturated throughout the year. In areas where wetlands remain considerably drier and do not frequently flood, the proposed trail can be developed on the native soil without becoming impassable or damaging the wetlands. In other locations, puncheons or boardwalks may be needed to ensure the trail remains passable.

Forested wetlands on the Reservoir property tend to be found in poorly drained depressions that are wet in winter and early spring but can be dry in late summer and early fall. They tend to be underlain



*Suitable habitat for State Species of Special Concern (NJDEP) on Reservoir property*



by soils with high clay content which impedes drainage. Forested wetland areas can often be identified by the large areas of bare saturated soils, buttressed (wide-based) trees, and distinct understory vegetation such as skunk cabbage or clumping sedges. Trees found in the forested wetlands on the site include pin oak, red maple, American hornbeam, green ash, bitternut hickory, American elm, American sycamore, and black gum. As with emergent wetlands, the trail may be able to traverse some forested wetlands, but structures may be advisable for some areas.

## Wildlife

The Reservoir site is host to a wide variety of wildlife, including species that are listed as endangered, threatened or of special concern by the U.S. Fish & Wildlife Service and the New Jersey Department of Environmental Protection. These species are afforded certain measures of protection to ensure their habitat is protected and their survival and recovery can be managed. Protection of the native wildlife, but in particular the endangered and threatened species present at the site is the next objective of the habitat improvement plan. Endangered and threatened species including the Bald Eagle, Indiana Bat, and Red Shouldered Hawk are confirmed to inhabit the property surrounding the Reservoir. Other species present include Red Fox, River Otter, Great Blue Heron, Wood Duck, Snow Goose, and Kingfisher. The proposed trail has been designed to minimize impact on the habitat of these species.

Field investigations conducted as part of the PMP identified suitable habitat for a significant variety of wildlife species on the site, including mammals, birds, snakes, turtles, amphibians, and insects. These are identified in the Ecological Evaluation accompanying the PMP, found in the Appendix. The site is capable of supporting several threatened and endangered species and what are known as State Species of Special Concern.

Of the species listed in the Table, Bald Eagle, Wood Thrush, Eastern Box Turtle, and Great Blue Heron were observed on the property during recent surveys.

Wildlife Species	Status
Bald Eagle	State Endangered
Bobcat	State Endangered
Bog Turtle	Federally Threatened State Endangered
Box Turtle	State Special Concern
Great Blue Heron	State Special Concern
Indiana Bat	State Endangered
Northern Long-eared Bat	Federally Threatened
Wood Thrush	State Special Concern
Wood Turtle	State Threatened

*Federally Threatened, State Threatened, and Species of Special Concern with potential to be found on Boonton Reservoir property.*



*Japanese barberry, an invasive species, in the forest at the Boonton Reservoir. Credit: Jack Morningstar*

## Chapter 6: Resource Management and Ecological Improvements

### **CHAPTER OVERVIEW**

- Trail will be carefully designed and sited to avoid impacting any wildlife species on the site. All trail design and siting will be subject to NJDEP oversight.
- Trail will be carefully designed and sited to avoid impacting sensitive wetlands on the site. All trail design and siting will be subject to NJDEP oversight.
- Stormwater improvement investments will be made on the property on at least 2-3 of the stormwater outflows identified in the Rippled Waters Engineering Stormwater Management Review (Appendix). Additional improvements will be added if funding can be secured. The exact location and design of stormwater improvements is to be determined but will follow best practices and will be similar or the same in concept to those outlined in this section and in the accompanying report.
- Invasive species will be managed in conjunction with stormwater improvement investments. Additional invasive species management may occur where positive natural resource impacts are feasible and where funding is available.



Stormwater improvement investments will be made on the property on at least 2-3 of the stormwater outflows identified in the Rippled Waters Engineering Stormwater Management Review (Appendix). Additional improvements will be added if funding can be secured. The exact location and design of stormwater improvements is to be determined but will follow best practices and will be similar or the same in concept to those outlined in this section and in the accompanying report.

There are two components to managing the natural resources on the Reservoir property: 1) maintaining the natural resources already located on the site through trail design and siting; and 2) improving the natural resource services provided by the property through stormwater management and native species planting. Together these will ensure the existing ecological integrity of the site is maintained, while addressing the biggest ecological concerns on the site and maintaining (and hopefully improving) the water quality of the Reservoir. While the exact characteristics and design of the trail and proposed improvements is to be determined, the project will ensure that existing natural resource assets are protected and that natural resource improvements are a robust component of the trail project.

### Trail Siting for Species Protection

The Reservoir site is privileged to be the location of a Bald Eagle nest. The presence of an established Bald Eagle nest and the importance of the Reservoir and surrounding forest to the eagle presents some challenges for siting a trail. The nest is located between the Reservoir and the property's western boundary which abuts Interstate Route 287. Federal guidelines call for a minimum buffer of 330 feet for certain activity near a Bald Eagle nest, in areas where the activity will not be visible from the nest. If a planned activity will be visible from the nest or if the activity has a higher probability of disturbance, a buffer of 660 feet is recommended.

The nest is in a relatively isolated location with mixed mature forest consisting of white pine, oak, and tulip poplar that provide a buffer between the nest and trail activity. The State



*Bald eagles with young at John Heinz National Wildlife Refuge. Credit: U.S. Fish and Wildlife Service - Northeast Region is licensed under [CC PDM 1.0](#)*



of New Jersey Endangered and Nongame Species Program recommends that the trail be located as far as possible from the nest and that eagle activity be monitored to determine whether a distance of less than 660 feet causes a disturbance to its nesting habits. If this were to be the case, it may be possible to make the buffer more effective by planting evergreen trees in the area to further screen the trail from the nest. Seasonal closing of sections of the trail during all or part of the breeding and nesting season (December through July) may be necessary as well. As the trail goes through the final design and permitting process, the necessary buffer will be determined.

The Reservoir shoreline is an important place where eagles can forage for food. Because the forest is fairly dense, the trail route is sufficiently distant from the shoreline so as not to disturb foraging eagles. Areas where the forest is not present, such as along the northern and southern impoundment walls, may still be utilized by foraging eagles. However, these areas may be considered generally less ecologically valuable to foraging eagles.

The great blue heron is another large State Special Concern bird species found at the Boonton Reservoir site. The Reservoir is particularly important for great blue heron, as they have established a rookery consisting of at least 5-10 nests on an island within the Reservoir. Great blue herons breed from early March to July. Breeding heron populations are sensitive to human disturbance. The remoteness of the island provides a relatively undisturbed setting for nesting and is free from the threat of mammal predators. The rookery site may also provide nesting for double-crested cormorants and great egret, who have been observed. Like the bald eagle, heron will also forage for food along the shore of the Reservoir, including vegetated areas and stone rip-rap areas along the northern and southern shore.

The rookery appears to be located at a sufficient distance from both shores of the Reservoir so that trail activity is not expected to disturb breeding. Nonetheless, the original trail route for trail phase 4 along the western shore of the Reservoir was relocated



*Great Blue Heron Boonton Reservoir, NJ, Credit: Jonathan Klizas – [www.mocosocobirds.com](http://www.mocosocobirds.com)*

more deeply into the forest to create a buffer to the shoreline and therefore the rookery. This helps ensure that human activity does not infringe on use of the island as a rookery by heron and other nesting birds. Although direct observation from the shoreline is not likely to disturb nesting, an observation blind has been incorporated into the trail as a further privacy feature.

The wood thrush is a migratory songbird found throughout New Jersey that breeds in the understory of woodlands and requires larger patches of forest to successfully reproduce. During the present study, the distinctive, flute-like wood thrush song has been heard along the eastern shoreline of the Reservoir. A significant decline in the population of wood thrush due to habitat loss and pressure from predatory birds has caused the species to be listed by the State of New Jersey as one of special concern. Although the Reservoir area is not mapped by NJDEP as suitable habitat for wood thrush, the nature of the forest there – including forested wetlands and native shrubs appears suitable for wood thrush breeding. As fragmentation of the forest is not proposed as part of the trail establishment, public access via the trail is not expected to adversely impact the viability of the forest surrounding the Reservoir as habitat for wood thrush or other forest nesting birds onsite. Management of white-tailed deer and restoration of the forest understory, particularly inclusion of berry producing shrubs (such



Wood Thrush. Credit: Joseph Higbee / [CC BY-NC 2.0](#)

as blueberries and viburnums) may help this species become more prevalent at the site.

The eastern box turtle is found in all 21 New Jersey counties, preferring open woodlands and meadows close to water bodies. Box turtles hibernate in underground or underwater burrows from late fall to April. Although the NJDEP Landscape Project does not map suitable habitat for box turtle near the Reservoir, suitable habitat does occur at the site and in adjacent areas where natural conditions occur along forested floodplain, although the long-term success of this species onsite may be affected by the Reservoirs relative isolation. One turtle was seen on site during field reconnaissance in the forest

near the Rockaway River. Although box turtles remain fairly common, their population is in decline. The species is adversely impacted by habitat destruction, which tends to prevent individuals from finding mates and reduces food supply. Other turtles identified through agency reviews include the federally endangered bog turtle and the state threatened



*Eastern Box Turtle. Credit: watts\_photos / [CC BY 2.0](#)*

wood turtle. These species are not likely to occur onsite based on the amount of habitat isolation that has resulted from surrounding development. Nevertheless, potential impacts to these species will be reviewed as part of state wetland and flood hazard area permitting.

Public access to the Reservoir site is not expected to have a detrimental effect on box turtles or other turtle species that might be found there. The main threat is collection for pets or removal of fallen logs and vegetation used for cover and nesting. These concerns could be noted on educational signage installed at the site.



*The bark of the Shagbark Hickory, found on the Reservoir site, is an ideal hibernating place for bats. Credit: John B / [CC BY 2.0](#)*

The Northern long-eared bat is a medium-sized bat about 3 to 3.7 inches but with a wingspan of 9 to 10 inches. During summer, roosting habitat includes live or dead trees. Singular or groups of bats may roost under the bark, in cracks or hollows of these trees and select tree species based on the presence of flaking bark, cracks and holes. The Indiana is a small brown to black colored bat with a wingspan of 9 to 11 inches. They appear to the untrained eye to resemble other common insect eating bats. Indiana bats rely on flying insects for food. Feeding takes place in and around the forested areas of the Reservoir.



Based on US Fish and Wildlife Service data, Northern long eared bat and Indiana bat hibernation and maternity roosts occur within the immediate vicinity of the Reservoir. The closest known hibernation location is in Rockaway Township and hibernating bats of these species would not be expected on the Reservoir property. There is, however, significant potential for roosting Northern long-eared and/or Indiana bats to occur onsite. Suitable roost trees, including a variety of large oaks, maples and hickories occur onsite. Large standing dead trees with flaking bark are also common along the forested shores. Many of the tree species found on the Reservoir site are favorable for roosting.

It would not be expected that public access to the Reservoir would result in any impacts to Northern long-eared or Indiana bats. Bats would not be expected to be displaced by visitors engaging in passive recreation, and the habitat quality and food supply for bats are not expected to be reduced as a result of use of the trail. The most significant threat to any bat population on-site would be management of the forest. The U.S. Fish & Wildlife Service New Jersey field office should be consulted prior to removal of any trees or limbs during the roost season (April through October), to determine whether these activities would impact known roosting trees. On the other hand, measures such as the installation of bat roosting boxes or other artificial roosting structures in appropriate areas may increase roosting opportunities for the Northern long-eared and Indiana bat. Educational information on bats at kiosks would be beneficial, as bats are very ecologically important and often misunderstood creatures.

### **Trail Siting for Wetland Protection**

The wetlands on the site were delineated and documented in the Summer of 2019. The route of the trail is designed to avoid ecologically sensitive habitats including wetlands. Where necessary, boardwalks and bridges will be installed to allow visitors to cross wetland areas while protecting sensitive ecological communities. While the exact routing and design of the trail is subject to change, the trail permitting process through NJ DEP will ensure that there are no wetland impacts associated with the creation of the trail. The Trail Design section of the PMP provides additional information on the design and parameters of the wetland crossings.

### **Stormwater Improvement Investments**

Additional discussion of this topic found in the Rippled Waters Engineering Stormwater Management Review in the Appendices.

As part of the proposed project, a combination of engineering solutions and native vegetation plantings are proposed to improve the ecological conditions and potentially improve local water quality at stormwater runoff locations. Currently, many drainage

areas are degraded, subject to erosion and sedimentation from silt and sand as well as pollution from floatable plastics and roadside chemicals.

Stormwater improvement investments will be made on the property on at least 2-3 of the stormwater outflows identified in the Rippled Waters Engineering Stormwater Management Review (Appendix). Additional improvements will be added if funding can be secured. The exact location and design of stormwater improvements is to be determined but will follow best practices and will be similar or the same in concept to those outlined in this section and in the accompanying report.

A diversity of native plant species may be used depending on the hydric regime and light penetration. More information on proposed native plant species can be found in the Amy Greene Ecological Evaluation (Appendix). Planting areas will be limited in scale and must be periodically monitored to assume long-term success. Invasive species control and deer exclusion must be incorporated.

### **Invasive Species Management**

Additional discussion of this topic found in the Amy Greene Environmental Ecological Evaluation in the Appendices.

Increases in global commerce and transportation over the twentieth century have created opportunities for exotic (non-native) species to be transported into new ecosystems where natural controls on their population may not occur. All vegetation communities at the Boonton Reservoir are affected by invasive species to varying degrees - more information on the proliferation of invasive species at the Boonton Reservoir site can be found in the Ecological Evaluation in the Appendix.

Invasive species presence is a fundamental ecological control problem within all Boonton Reservoir vegetation communities. Control of any individual species is complex due to the persistence of seed banks or root material in the soil, compounding effects of deer population, and reintroduction from adjacent development. Any proposed control of invasive plants must carefully consider long-term maintenance including deer exclusion or control.

Prior to enacting the small-scale habitat enhancement plantings associated with the proposed project, invasive species control and monitoring must be considered and implemented in the discrete location where the plantings are to occur. Any use of herbicides must be applied by a State licensed and appropriately trained individual. Methods such as stem injection, cut stump and basal bark applications may be most appropriate. Herbicides will be used only with careful consideration and if it is determined to be the most appropriate method for invasive species control.

Other methods that may be utilized are removal by hand or mechanical means in dis-

crete locations, such as in conjunction with stormwater management improvement sites. Hand removal is the most habitat sensitive method but is labor intensive, time consuming, and likely less effective as seed stock and root fragments are more likely to remain.

Once the plans for the stormwater improvement sites are finalized, consultation with the Morris County Park Commission and ecological restoration specialists can assist in the development of a feasible and practical approach to managing invasive species in those areas and potentially in other areas where invasion removal will be effective at improving natural resource outcomes. Outside of the stormwater improvement areas, invasive species management will be subject to funding availability and MCPC policy.

### White-Tailed Deer Management

White-tailed deer have had a significant impact on the ecology of the Boonton Reservoir site. The domination of the forest understory by invasive species at the expense of native species is likely the direct result of a deer population that exceeds the carrying capacity of the site. Male and female deer of all ages are regularly observed during daylight hours in all habitats onsite. The predominance of less palatable invasive herbaceous and understory species and the lack of native understory vegetation and seedling presence in many forest locations is the direct result of deer densities above carrying capacity. Reduction of the white-tailed deer population on the site would increase the possibility that the diversity and number of native plants in the forest can be increased.

Large scale deer exclusion would be difficult, as the species are capable of jumping six-foot fences and can easily enter and exit the Reservoir through fence holes, gate gaps, etc. The MCPC will explore additional deer control methods, such as permitted controlled hunting, in accordance with their policies. For the protection of smaller-scale planting projects, deer exclusion barriers will be installed, monitored and maintained. The MCPC will explore additional deer control methods.

### Early-Successional Pollinator Planting

It is understood that most maintained areas such as the Reservoir berms and lawns near facility areas are required to be maintained with cool season grasses and regular mowing. However, some areas such as a portion of the maintained field adjacent to the entrance of the Dam facility could present potential for pollinator planting.

Plantings of warm season grasses, combined with various native wildflowers such as milkweeds, aster, goldenrods, coneflower, field thistle, and bee balm would improve the ecological value and function of maintained uplands. Native early successional grasslands have ecological value by providing nectaring and larval host plants to insects (in-



cluding butterflies and honeybees). In addition, even small grasslands may be utilized by migratory or foraging grassland bird species such as savannah sparrow and other songbirds. Educational signage explaining pollinator relationships could be effectively utilized in conjunction with these areas and provide a significant aesthetic and ecological focal point to Reservoir visitors.

Should funding and capacity be available, it is recommended that MCPC and partners explore these pollinator plantings to improve the ecological health of the Reservoir uplands.

### **Environmental Education**

This project provides numerous opportunities for the public to learn about the natural resources on the Boonton Reservoir property and the drinking water system of Jersey City. Preliminary conversations with community groups, such as the Great Swamp Watershed Association, have identified opportunities for public education at the Reservoir site. Ideas such as turning an old laboratory on the property into a “learning lab” and organizing field trips to conduct water sampling will be explored once the trail is in the final design and permitting stage.

## Appendix

### **BOONTON RESERVOIR PROTECTION AND TRAIL PROJECT**

#### **Lease Agreement & MCPC Resolution**

Between MCPC and Jersey City

#### **Memorandum of Agreement**

Between OSI and MCPC

#### **List of Stakeholder Interviews**

Notes from all stakeholder interviews and public meetings

#### **Stormwater Report**

Prepared by Rippled Waters Engineering, LLC

#### **Ecological Evaluation**

Prepared by Amy S. Greene Environmental

#### **Patrol and Emergency Response Plan**

Prepared by Parsippany OEM Coordinator Jay Weiners

#### **MCPC Rules and Regulations and Policies**

The Commission's General Rules

#### **Phase Maps**

Overall map and individual phase maps

#### **Table of Cost Estimates**

By Construction Phase