CONSERVATION MANAGEMENT PLAN

FOR THE FORMER NEW JERSEY PULVERIZING TRACT

JULY 2021

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EXECUTIVE SUMMARY

CONTEXT, PURPOSE, AND GOALS

For several years, staff representing Ocean County Department of Planning and Ocean County Department of Parks and Recreation have considered restoration alternatives for the Former New Jersey Pulverizing Tract. The County purchased the 782-acre sand and gravel quarry, located in Berkeley Township, in 2016 using funds from the Natural Lands Trust. The County's restoration objectives incorporate ecological improvements, extension of public trails access to (and through) the site, and establishment of a long-term landscape design lending itself to sustainable, cost-effective stewardship as a key Natural Lands Trust preserve.

The Conservation Management Plan for the Former New Jersey Pulverizing Tract (hereafter, "Pulverizing site") responds to the County's directive by presenting a composite view for land restoration as a *mosaic* of open water, wetland, emergent meadow, grassland, and forest linked by miles of new recreational trails. The site's public access system combines 8.1 miles of planned pedestrian paths and multi-use bicycle trails. All trails will connect with the County's Barnegat Branch Trail, an existing 15.6-mile regional facility that runs for 1.4 miles through the Pulverizing site's eastern reach. The plan also contains a unique 3.0-mile water trail that connects existing dead-end mining channels through a series of excavated shallow cuts. The water trail will unlock a range of paddling routes that offer kayakers and canoeists unequaled access to restored and protected ponds, wetlands, fishing and picnicking coves, and terrestrial zones including birding meadows and oak-pine forests.

EXISTING CONDITIONS

Today, portions of the Pulverizing site present poorly as a degraded landscape, the result of nine decades of continuous sand and gravel extraction. With the exception of a forest perimeter buffer, nearly all land within the site was mined and lowered substantially in base elevation. The result is a bowl-like landscape of exposed and compacted soils, forest, and wetland areas, a sterile 42-acre lake, a phalanx of mining roads, ATV tracks, steep slopes, ruts, and dirt piles. Large areas are bereft of topsoil and secondary organic soil layers, and the floor elevation is sitting an average of 35 feet below the grade of abutting, unmined residential, institutional, and vacant lands.

The wetlands, streams, and topography that once stored water, managed on-site recharge, and drainage to the Barnegat Bay via Mill Creek have been lost to excavation. Thankfully, water quality within the site is remarkably good and represents a key scientific finding of our early evaluative work. It serves as a benchmark for successful habitat creation initiatives contained in this plan. The site is host to a representative mix of native plant communities that speak to various stages of ecological succession and vegetative recovery. These findings inform the plan's ecological design recommendations, and confirm the site's fundamental resilience, restoration potential, public access opportunities, and scientific and interpretative value.

TRANSITIONING TO A NATURAL LANDS TRUST PRESERVE

The effort to transition the Pulverizing site from a modified mining pit to a Natural Lands Trust preserve is multi-faceted. The program requires a light hand and a cost-effective approach adapted to observed ecological successes. The program will require a phased design and construction effort that capitalizes on existing hydrology, creates, and restores damaged habitat areas, and lays the foundation for the land and water trail system.

For some areas, an intensive effort will be needed to realize recommended design objectives, including connecting waterway extensions for the water trail, construction of the multi-use trail system (including parking areas and several light-duty bridges), reestablishment of stream connections, restoration of ephemeral wetlands, and regrading portions of the main lake shoreline to improve vegetative recovery and production, fishery habitat, and to enhance public safety due to steep underwater banks. In addition, grading and replanting will be required to restore numerous discrete eroded land areas, along with creation of an extensive coastal grassland of 125-acres, ideal for birding, will require regrading, seeding, and planting, followed by protection against unauthorized vehicular trespass. For remaining lands within the Pulverizing site, the natural process of vegetative succession is underway.

Despite the complexity outlined above it should be reemphasized that not all land within the site requires restoration. Thankfully, there are several large areas within the Pulverizing site that can be left to succeed – incrementally – from the current ecological stage to the anticipated end-state position per the narrative and mapping discussion of habitat preservation areas. This plan balances active and passive efforts to transition the Pulverizing site from a sand pit to a unique Natural Lands Trust preserve.

THE COMPREHENSIVE MANAGEMENT PLAN

The plan for the Pulverizing site is derivative of two overarching goals: First, provide ecological uplift; and second, provide an extensive system of passive recreational public access. Ecologically, restoration areas and sub-areas have been designed to reconnect shallow groundwater and surface waters, wetlands, and uplands in an effort to simultaneously capture and shed stormwater. The trail routing for pedestrian and bicycle trails, as well as the water trail for kayak use, is intended to bring visitors to all corners of the site, and to enjoy unique habitat areas and special features.

As such, all habitat maps and trail routing plans shown in this document are conceptual and should not be read as a fixed, absolute, or permanent boundary. As noted,

large portions of the Pulverizing site permit flexible and adaptable design with allowable overlap and blurring of habitat edges. The maps and multi-hued polygons that depict habitat creation and habitat preservation areas should be viewed as an artist's palette with the site serving as the canvas. The plan leaves room for expansion, reduction, merger or the 'right' of selected habitat areas 'to be left alone.'

The plan contains options for integrating restoration with stewardship priorities to be established by the County. The intention is to restore diversity and function, and to attract the greatest number of users – human and nonhuman alike. That said, increased public access must be sustainable with trail networks respective of sensitive habitat and built about an active educational and interpretive program.

MANAGEMENT PLANNING AREAS

The Comprehensive Management Plan utilizes a three-part structure for differentiating the work required to improve the site: **Public Access Areas** consist of parking and embarkation, land trails for pedestrian and bicycle access, water trails for kayak and canoe access, and lakeshore public access. **Habitat Creation Areas** include fishery development, connecting waterways, emergent and seasonal wetlands, bogs, grassland, and an improved stream connection between the main lake and the Barnegat Bay. **Habitat Preservation Areas** have been mapped for protection of mixed pine-oak forest, mature pine forest, and specified wetlands and open waters.

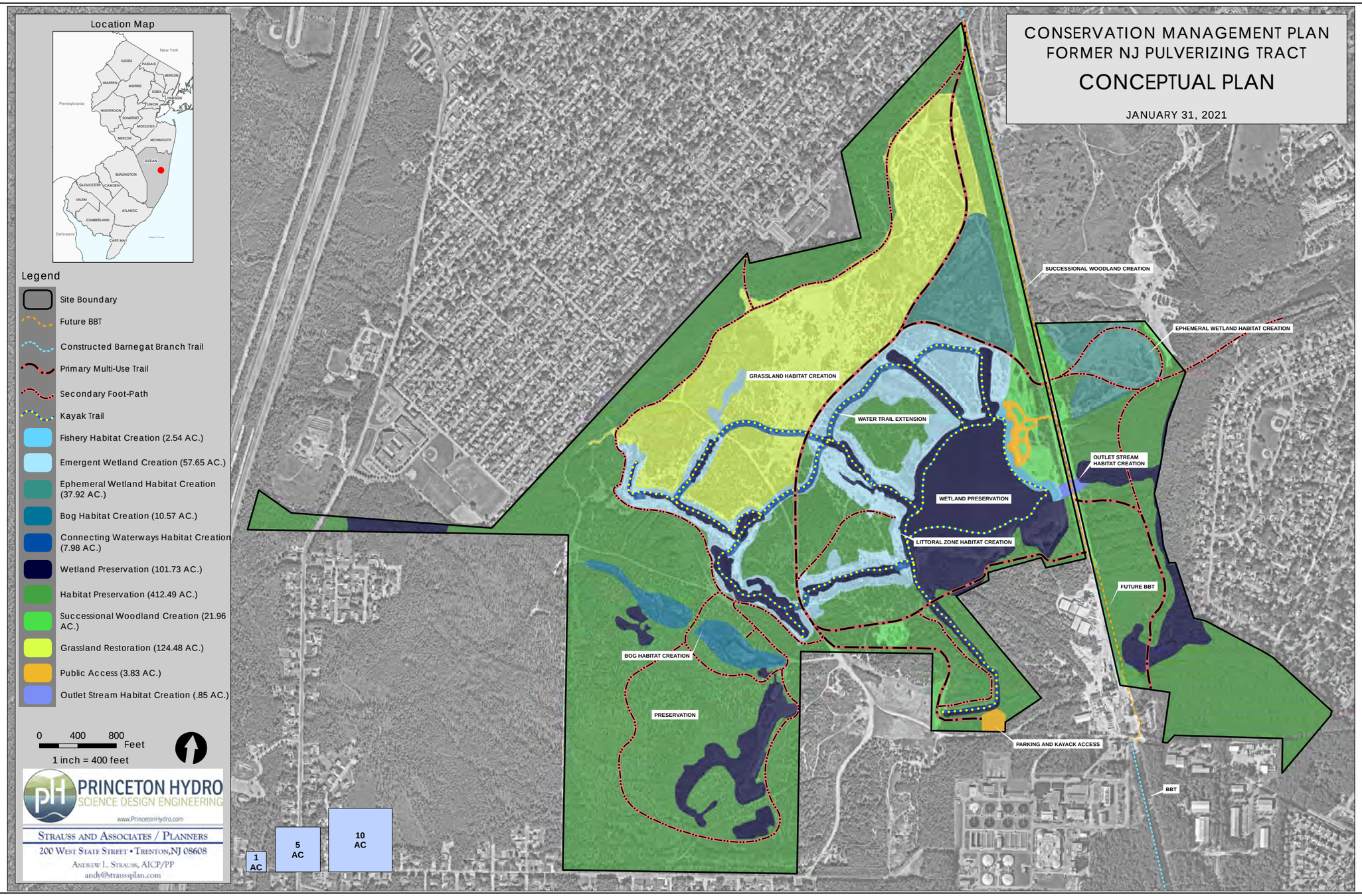
PLAN IMPLEMENTATION

Implementation for a project of this scale should follow a 5- to 7-year horizon that combines preliminary and final design, environmental permitting, and phased construction. The phasing plan allows for some modification but establishes a timetable for completing core improvements such as parking areas, trails (land and water), lakeshore improvements, stream work, and restoration of emergent wetlands. A series of planning and design decisions must be reached by the County. Some of these decisions involve the size, location and phasing of parking areas, routing of multi-use and water trails, selection of priority habitat creation areas, and the construction of the Barnegat Branch Trail section within the site.

The County should develop a series of sub-area plans for lakeshore public access, open bottom culvert design for Mill Creek, key trail junctions, maintenance facilities, staffing and public safety plans. A series of technical items must also be completed: topographic surveys, engineered streambed and channel designs, hydrologic studies, and comprehensive project management for advancing and revising plans, designs, permits, and integrating construction work (specifications, final plans, cost estimates, and public bidding).

Plan implementation needs to be responsive to Ocean County decision-making, funding, and staffing objectives. Not all changes can be made at once. As such this plan incorporates a proposed phasing plan based on five-year state permit timelines with an eye on constructability, access, and protection of completed improvements. Some improvements should be implemented with assistance from outside contractors while others can be completed using County staff and equipment. Some elements may qualify for outside grants including federal, state, or philanthropic foundations, while others must be programmed through the County's operating and capital budget program.

The Pulverizing site offers exciting opportunities to apply adaptive and restorative design in furtherance of ecological and public access objectives within the incredibly diverse 782-acre tract. Restoration, preservation, and stabilization of the mine landscape will provide a diverse and continuously changing experience to visitors of all ages and interests. As a jewel in the necklace of the Natural Land Trust system, the Pulverizing site will enrich the natural resource base, will provide a mind-changing visitor experience, and will reinforce the prescience of forward-thinking officials at Ocean County who embarked on, and advanced, the objective of acquiring and restoring an abandoned sand and gravel quarry.


Location Map
New York
Pennsylvania
Delaware
SUSSEX
PASSAIC
BERGEN
WARREN
MORRIS
ESSEX
HUDSON
UNION
HUNTERDON
SOMERSET
MIDDLESEX
MERCER
MONMOUTH
OCEAN
BURLINGTON
GLOUCESTER
CAMDEN
SALEM
ATLANTIC
CUMBERLAND
CAPE MAY
Legend
Site Boundary
Future BBT
Constructed Barnegat Branch Trail
Primary Multi-Use Trail
Secondary Foot-Path
Kayak Trail
Fishery Habitat Creation (2.54 AC.)
Emergent Wetland Creation (57.65 AC.)
Ephemeral Wetland Habitat Creation (37.92 AC.)
Bog Habitat Creation (10.57 AC.)
Connecting Waterways Habitat Creation (7.98 AC.)
Wetland Preservation (101.73 AC.)
Habitat Preservation (412.49 AC.)
Successional Woodland Creation (21.96 AC.)
Grassland Restoration (124.48 AC.)
Public Access (3.83 AC.)
Outlet Stream Habitat Creation (.85 AC.)
0 400 800 Feet
1 inch = 400 feet
PRINCETON HYDRO
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CONSERVATION MANAGEMENT PLAN
FORMER NJ PULVERIZING TRACT
CONCEPTUAL PLAN
JANUARY 31, 2021
SUCCESSIONAL WOODLAND CREATION
EPHEMERAL WETLAND HABITAT CREATION
GRASSLAND HABITAT CREATION
WATER TRAIL EXTENSION
OUTLET STREAM HABITAT CREATION
WETLAND PRESERVATION
LITTORAL ZONE HABITAT CREATION
FUTURE BBT
BOG HABITAT CREATION
PRESERVATION
PARKING AND KAYACK ACCESS
BBT
1 AC
5 AC
10 AC

SECTION ONE

INTRODUCTION & PROJECT OBJECTIVES

The Former New Jersey Pulverizing Tract (hereafter, "Pulverizing site") is fundamentally a degraded landscape created by nearly a century of sand and gravel extraction. Today, portions of the site are home to a mosaic of plant communities representing various stages of ecological succession and vegetative recovery. The existing topography is a snapshot of the pit's final decade of extractive use which has resulted in an anthropogenic (man-made) landscape consisting of abandoned stockpiles, scattered debris, steep slopes, a deep lake, pockets of ponded water, and soils compacted by heavy all-terrain vehicles (ATV) use.

Despite the site's disturbance history, portions of the 782-acre study area remain difficult to access and have quietly undergone the process of ecological succession, resulting in recolonization and reforestation by native species, a confirmation of the site's resilience. One cannot appreciate just how much natural character and opportunity exist until the site is walked, analyzed and evaluated in granular detail, and across several seasons. This is exactly the approach taken to this Comprehensive Management Plan by the team of Princeton Hydro, LLC + Strauss and Associates / Planners. We have come to believe in the site's enormous ecological and recreational potential.

It is the marriage of the Pulverizing site's mining history and nature's handiwork that make the property unique and worth acquiring and restoring. The 2015 decision by the Ocean County Freeholders, led by late-Freeholder Director, John C. Bartlett, Jr., to complete the acquisition with support from the County Planning Department and funding from the County Natural Lands Trust, serve as testament to governmental prescience. Ownership of a highly disturbed and exhausted sand pit was neither a quick or inexpensive decision by the Freeholder Board. Previously, the site was under contract in the late 1990s for plan approvals and construction of 4,500 homes by the K. Hovnanian Company.

This plan will help to guide Ocean County decision-making across several fronts: planning and design; permit submittals; timing and extension of public trail access to and through the site; construction funding; ecological interpretation and education; and land stewardship and staffing obligations.

The Conservation Management Plan for the New Jersey Pulverizing site is driven by six objectives:

PRESERVE WHAT IS BENEFICIAL.

Protect the best examples of existing upland and wetland plant communities. The site contains a range of productive native plant communities representative of the New Jersey pinelands and Barnegat Bay Watershed. The plan identifies and extends protection to these localized communities.

CREATE AND REPLACE WHAT IS DAMAGED.

Rebuild native plant communities through the introduction of wetland littoral zones and benched (or stepped) terrestrial habitat. Decades of mineral extraction and misuse have resulted in denuded, desert-like zones. The plan draws on pineland ecological analogs to reestablish native plant communities.

RE-ESTABLISH HYDROLOGIC CONNECTIONS.

Restore the site's hydrologic connections to both pinelands and Barnegat Bay areas. The plan contains a range of treatments to restore and expand wetlands and open water, reconnect the native fishery, and diversify aquatic and terrestrial habitat.

BUILD AN INTERCONNECTED TRAIL SYSTEM.

The plan establishes a hierarchy of pedestrian and bike trails enabling public access to all corners of the site and connecting the site to the Barnegat Branch Trail. As a premier Natural Lands Trust preserve the restored Pulverizing site will attract bicyclists from trail towns including Toms River, Beachwood, Bayville, Forked River, Waretown, Barnegat and beyond.

EXPAND WATER TRAILS FOR KAYAK AND CANOE ACCESS.

Surface water connections will be enhanced by excavating a series of waterways and emergent wetland habitat. The plan links the existing radiating lagoon fingers to one-another and to the 42-acre lake. The new connections will improve circumferential paddling routes, backcountry destinations, habitat protection and management.

INCREASE ECOLOGICAL REGENERATION (UPLIFT) THROUGH COST-EFFECTIVE CONSTRUCTION.

The plan recognizes that – ecologically speaking – nearly everything required for long-term success is already on-site, including hydrology, native plant communities, and seedstock. There is limited need for imported material, fertilization, or complex engineering. Although the site is significantly degraded, the plan incorporates a substantial amount of habitat preservation and limits most earthmoving activities to the area around the main lake.

The plan is derivative of two overarching principles: First, provide ecological uplift; and second, provide passive recreational access to the public. Ecologically speaking, the plan's design recommendations complement ongoing natural processes while working to correct and naturalize significant impairments.

The plan's ecological uplift elements are grouped into two design approaches: habitat *creation* and habitat *preservation*.

HABITAT CREATION AREAS

For purposes of this plan the term habitat 'creation' extends to habitat restoration and habitat enhancement. Creation covers all areas modified to reset the path of ecological succession. Areas proposed for creation have been severely impacted by mining and ATV use, or have failed for other reasons, including the loss of hydrologic connections. Creation areas promote biodiversity and will be planted with species indigenous to the pinelands; some areas will mimic historic habitat types while other areas – such as the grassland – will be entirely new but consistent with similar (analog) pineland communities. Actions include development of new shallow waters, elimination of steep underwater and terrestrial slopes, removal of eroded soil stockpiles, and decompaction and seeding of hardpan areas.

HABITAT PRESERVATION AREAS

This plan does not propose modification of designated habitat preservation areas, as these areas presently possess well-established communities containing high-quality habitat and aesthetic value. While these areas are productive and stable, they will require protection and periodic management at a scale considerably less intensive than that required for creation areas. The design objective for preservation areas speaks to sustaining and guiding, rather than altering the current state.

Habitat design seeks to establish a positive ecological foundation for natural succession and species development. This recognizes that habitat communities require time to develop, cycle, and evolve. Habitat design is not simply a front-end construction exercise but accounts for long-term processes of soil development and stabilization, soil enrichment through seasonal layering of organic matter, wetland development through stabilized hydrology and volunteer establishment of native plants, and the time required for a forest canopy to develop.

The Pulverizing site's value as a Natural Lands Trust asset will be most appreciated once the public can access and enjoy the recreational and environmental features outlined in this plan. Our team has designed a unique overlay of land and water trails that expand beneficial public access to habitat areas. The process of introducing visitors throughout the site will assist the County's site stewardship and public safety obligation.

SECTION TWO

LOCATION, SITE HISTORY, AND LEGAL ENCUMBRANCES

LOCATION

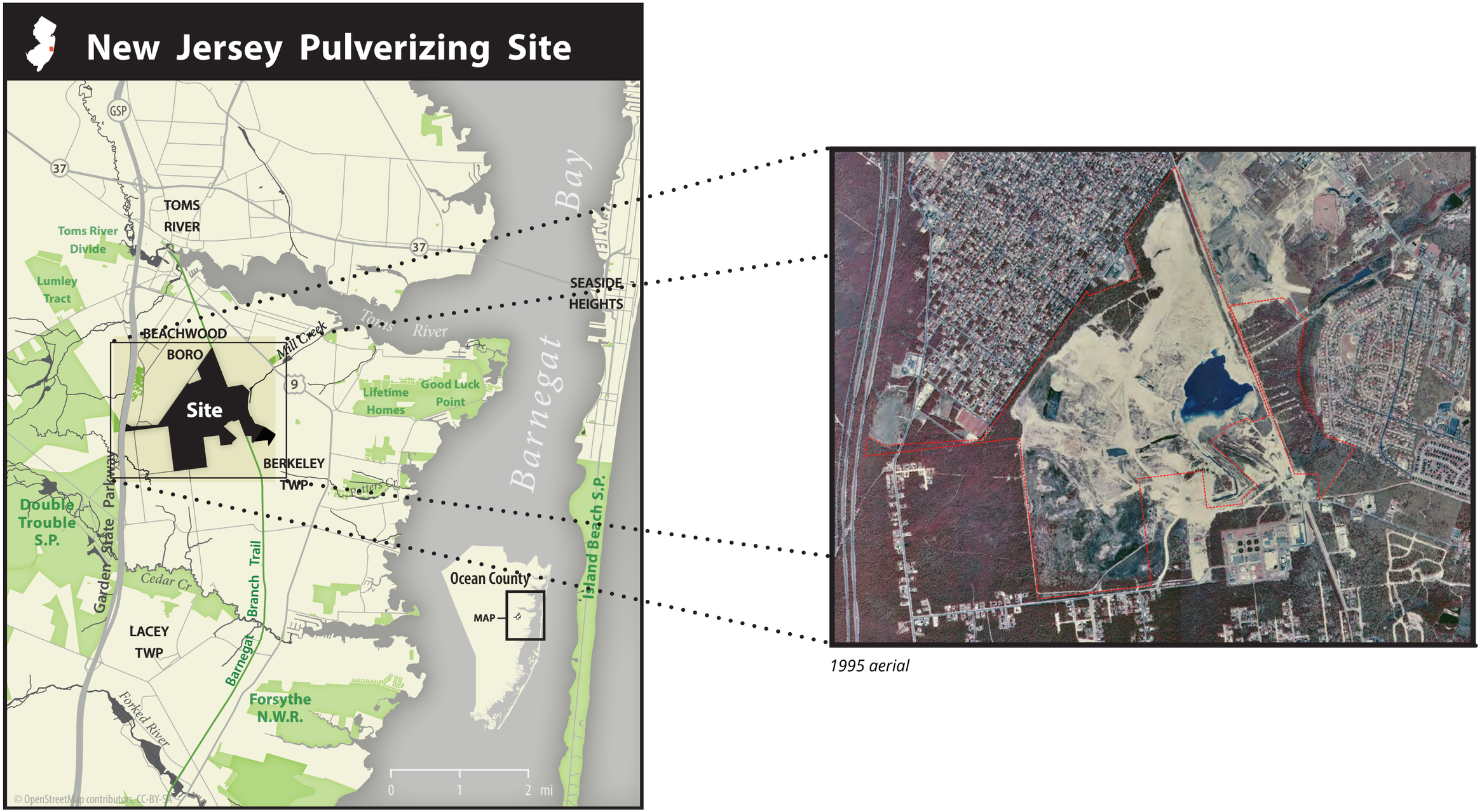
The 782-acre New Jersey Pulverizing site is situated in the northern portion of Berkeley Township just north of Hickory Lane, southeast of Beachwood Borough, and midway between Route 9 (to the east) and the Garden State Parkway to the west. For over fifty years – from the 1920s through the 1970s – transport of materials was provided by the Central Railroad of New Jersey's Barnegat Branch, whose right-of-way runs north-south through the site. Since the early 1980s all material exported from the site has been moved by truck via the Hickory Lane entrance.

Adjacent land uses include residential, commercial, industrial, and institutional utility. The western and northwestern portions of the site are bordered by Beachwood Borough, whose dense 1920s residential plat and build-out provide the Pulverizing site's highest concentration of abutting homes, schools, community activity and potential for public access. Situated to the northeast, east, south, and southwest are a range of medium-density residential neighborhoods of Berkeley Township including the proposed Town Center located on several large vacant tracts near Rt. 9, and to the east and southeast a mix of commercial, residential and vacant tracts. A portion of the Pulverizing site's southern boundary consists of Hickory Lane and Segal Avenue, which contain medium-density industrial uses such as Henriques Yachts, Inc. along with the Ocean County Utilities Authority (OCUA) Central Division sewage treatment plant, and Empire Blended Products, Inc., a cement blending and distribution facility located inbound along the southern portion.

Several vacant, underutilized parcels are situated along the site's perimeter to the west and northeast, including lands owned by Berkeley Township and several private owners. Key parcels should be considered by Ocean County for acquisition and consolidation into the Pulverizing site as they contain important habitat and buffering values. Berkeley Township presently owns a 170-acre parcel situated at the western boundary of the site (at the foot of Segal Avenue), and known as TDR Sending Zone "D."

A portion of the original Pulverizing tract was subdivided and retained by the New Jersey Pulverizing Company (d/b/a Empire Blended Products) for continued operations with a right of purchase held by Ocean County in the event Empire decides to sell, relocate, or terminate operations. In addition, a 55-acre section of the original purchase property was subdivided and conveyed to the OCUA for operational buffer. This tract is not technically part of the study area, however, there are opportunities for restoration and collaborative land use.

Pulverizing grinding shed today (left).



1995 aerial

FIGURE 1: *The 782-acre Former New Jersey Pulverizing Tract is located in Berkeley Twp., south of Toms River, and connects with a range of state, county and municipal parks, the Mill Creek and includes a 1.4-mile segment of the Barnegat Branch Trail.*

SITE HISTORY

The mine property was assembled by the Triangle Pulverizing Company in 1923, and subsequently purchased by Ervin W. Fisher's New Jersey Pulverizing Company as a sand reserve. Fisher was something of an East Coast sand magnate, with three pulverizing plants operating in South Jersey and West Virginia. Fisher needed the Bayville site for silica deposits for the manufacture of soap, industrial abrasives, glass, and construction materials. It was recognized that a railroad siding was a necessity to fully-develop an integrated silica pulverizing operation, a sand mine and a dry-concrete manufacturing facility at railroad Mile Marker 50, formerly known as Quail Run, Bayville.

Fisher and partner Harry Spier built a factory plant fitted with custom-designed rock-filled drums to grind, wash, and dry quarried sand into fine silica. Small-gauge rail lines were built to move product from the quarry to several workstations within the plant. The finished result was funneled into bags for loading onto railroad freight cars stacked along the spur west of the main line.

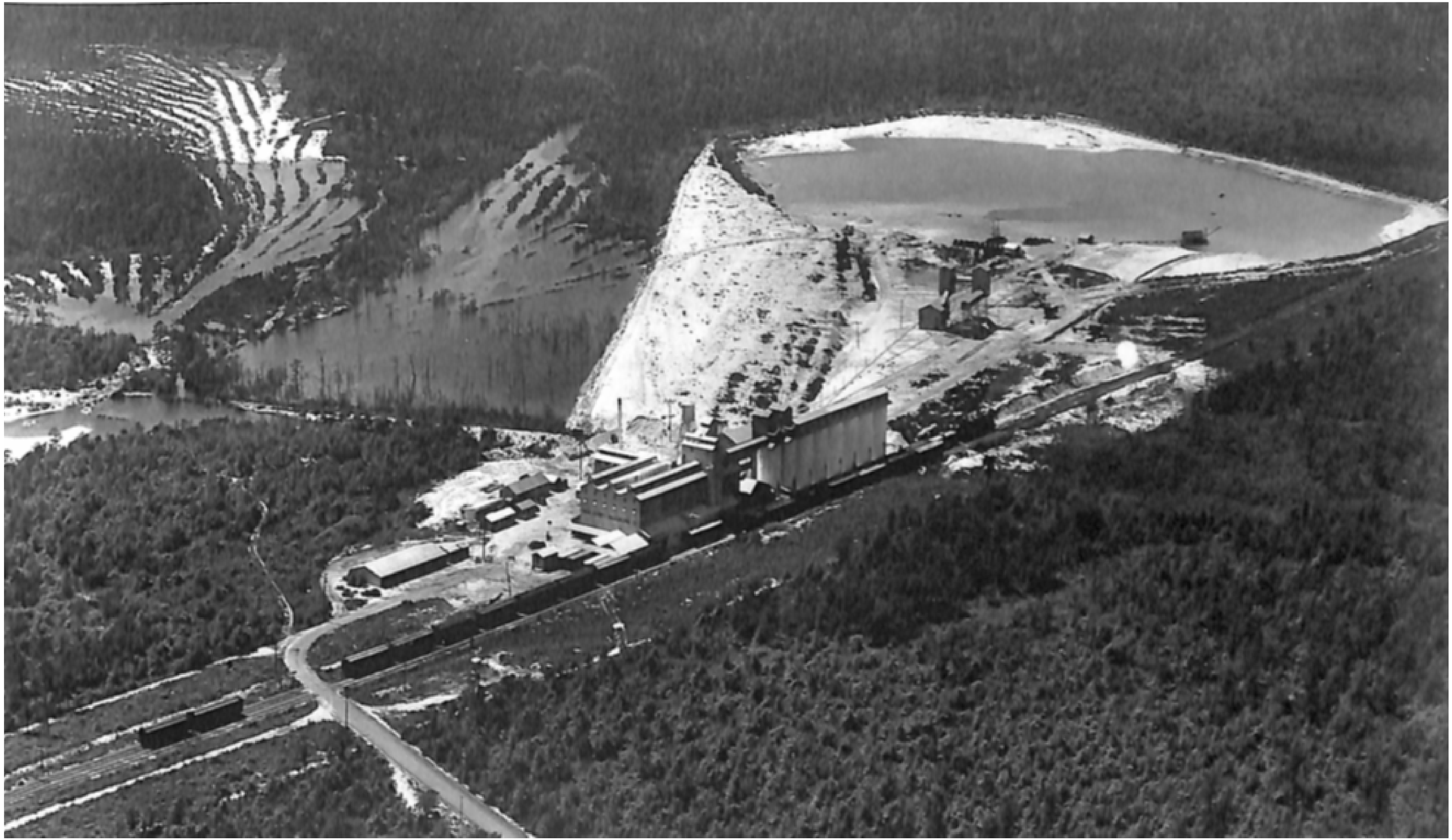
Ervin Fisher died in 1933 and Arnold Tanzer of New Jersey Pulverizing's New York sales office took over the company. Over the next four years, Tanzer and partner Arthur Schlesinger built new industrial processing facilities of sand excavated on-site and installed the enormous concrete silos along the west side of the railroad. Pulverization of sand for silica proved the main activity until the silica-suitable top layer of white sand ran out. Although the company acquired additional acreage it eventually switched to dredging, washing, drying and packaging the coarser yellow sand beneath and, ultimately, abandoned the complex process of pulverizing solely for silica. The silos remain today, a historical relict of early modern industrial architecture.

New Jersey Pulverizing proceeded to mine and process different varieties of sand at the site for the next four decades until the 1960s when Arnold's son, Marty Tanzer, took the helm. While formerly shipping an average of 60 carloads of sand each week along the Barnegat Branch, Pulverizing was down to two carloads a week by the time Conrail assumed control of the line following the 1976 bankruptcy of the Central Railroad of New Jersey. By the early 1980s freight rail operations ceased and the company switched unhappily to trucks. Shortly thereafter all remaining track, tie, signal, and crossing equipment was stripped and salvaged, and the rail corridor acquired by Ocean County for development of the Barnegat Branch Trail.

Although active extractive mining work ceased on or about 2015, the manufacturing facility, including silage, dry-concrete mixing and warehousing, continue as an active business, which includes the import of materials for specialty blends. All of this takes place within a 45-acre parcel separate from the 782-acre study area.

Pulverizing plant c. 1930s looking north to mill and grinding towers. Note railroad boxcars located to extreme right. (Courtesy, Al Stokely)

Pulverizing plant interior c. 1930s with sorting and packing equipment. For over 50 years, all finished products left the site via rail. (Courtesy, Al Stokely)



Pulverizing site c. 1930s aerial view looking northwest over mill and silos, rail corridor, and excavation areas. (Courtesy, B. Bovasso)

LEGAL ENCUMBRANCES

A review of the title, survey, and legal encumbrances was performed as a measure of planning due diligence. Our analysis supports the recommendations contained in this plan and we are pleased to report the County is in good shape for proceeding with work required to improve the Pulverizing site. There remain boundary questions that color subsequent phases, however, these are minor and are not deal-breakers, individually or collectively. Most will be resolved via facts, wise counsel, and the historically good communication that Ocean County maintains with its public, quasi-public, and private partners.

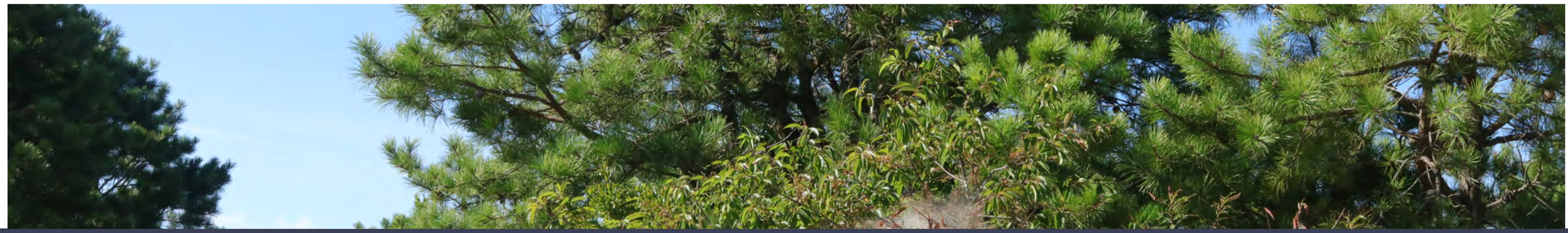
Specifically, we have examined legal and physical access for the design of Phase I elements, including: location of the public parking and embarkation area, access for County maintenance vehicles to the main lake and proposed maintenance facilities, trail system routing and connectivity, utility easements affecting habitat creation, and rights held by abutting landowners, municipalities, and third-party entities. Our review is preliminary with additional survey recommended for future special area plans, preliminary engineering, state permit applications, construction access, and issuance of temporary easements for construction.

Ocean County holds marketable fee simple title to the principal 762.7-acre Pulverizing Tract conveyed at closing (2016). This was followed by purchase of an abutting 19.6-acre tract (2019), bringing the total of the subject study area to 782.3 acres (rounded to 782 acres). At the 2016 closing a separate 55-acre parcel was subdivided and conveyed to the OCUA for buffer and operations. This parcel is excluded from the study area and acreage calculation. As previously noted, another 45-acre parcel was subdivided and retained by the seller for continued manufacturing. The County's acquisition of the Pulverizing site was subject to several nonconforming, excepted parcels of grey title that pose no threat to project development, as their equitable owners are unknown (and probably unknowable). Their combined acreage is incorporated in the total, above. Lastly, the 2016 acquisition excluded the Barnegat Branch Railroad corridor which the County acquired in 2003 as part of its 15.6-mile regional rail-trail project.

In addition to holding good title to the 782-acre Pulverizing site, Ocean County has rights to two interior transportation corridors totaling 12 acres. These strips consist of 1.4 miles of marketable title to the aforementioned Barnegat Branch corridor which runs north from Hickory Lane in Berkeley Township to Berkeley Avenue in Beachwood Borough, and a reversionary interest to a 0.9 mile section of Segal Avenue, a dedicated Berkeley Township public street. The first part of Segal Avenue – outside of the County's reversionary interest – runs west 600 feet of its intersection with East Railroad Avenue, is asphalt-improved and provides gated access to OCUA's treatment plant. The remainder portion of Segal Avenue runs west nearly 5,000 feet and is an unimproved paper street of which half is compacted sand with the rest covered by high quality pine forest and wetlands. We recommend the County work with the Township to vacate a minimum of 2,400 feet of the unimproved portion of Segal Avenue so that it can be consolidated and managed as a forest-wetland per recommendations contained at Section 4 of this plan.

Separate from the transportation corridors are five utility and driveway access encumbrances which affect the study area. While the four encumbrances involve the Barnegat Branch Trail corridor (a County-owned tract purchased with Natural Lands Trust funds), these encumbrances and the improvements within require additional survey and thoughtful consideration during the restoration design process. The encumbrances involve three utility easements – which are permanent and run with the land – followed by two non-permanent occupations that do not run with the land.

Three **utility easements** benefit electric, sewer and natural gas service providers: Jersey Central Power & Light (JCP&L); Ocean County Utilities Authority (OCUA); and New Jersey Natural Gas (NJNG). The JCP&L and OCUA easements are located within the Pulverizing site just east of the railroad corridor. Land restoration work recommended by this plan will require written permission by the easement holder. Restoration will improve long-term safety, maintenance and negative access associated with easements and related infrastructure.



A high-pressure natural gas pipeline owned by NJNG runs beneath the Barnegat Branch Trail. While technically not part of the Pulverizing site's title, the pipeline and easement holder must be involved in land restoration discussions, as work to reconnect the main lake with Mill Creek requires modification to the soil beneath the gas pipeline, easement area and the larger rail embankment. An as-built survey, design review, and temporary construction access will be requested of NJNG by Ocean County.

A **temporary license** issued by Ocean County in 2016 allows private driveway access to facilities owned by the New Jersey Pulverizing Company subsidiary, Empire Blended Products. The facilities consist of a series of concrete silos and manufacturing buildings which occupy a 45-acre parcel retained by the Seller, and are excluded from the 782-acre study area. The recorded license allows for vehicular access from Hickory Lane north along an unimproved strip 80 feet in width and 1,850 feet in length. This strip is located atop the bed of the Barnegat Branch Railroad and has served as the plant's access for four decades. The license allows driveway access to be resized, relocated or vacated pending negotiated and agreed-to amendments. Amendment of the license is recommended to provide for the redesign of trail access, fencing, landscaping, signage and amenities associated with co-development of the Barnegat Branch Trail and restoration work contemplated by this plan.

Finally, a **recorded municipal ordinance (1989) and agreement to reconfirm an area of dedication for a future roadway (2016)** attempt to establish a planning and quasi-legal basis for a roadway known as the Western Boulevard Extension. This long-discussed arterial would provide future access from the central residential portion of Berkeley Township northeast across the site to a redevelopment area known as the Berkeley Town Center at Route 9. The roadway would be fit within a portion of a 500 foot wide right-of-way arcing west of the lake. Together, the recorded documents bear a faded, penumbra-like resemblance to an encumbrance, however, they lack a grant of easement or an official dedication of right-of-way as required by ordinance or recorded plan filing, and the 500 foot wide proposed corridor does not appear on municipal tax maps, municipal or county master plans, Ocean County's title insurance policy or endorsed survey reviewed as part of our due diligence for this project.

Together, the encumbrances referenced above do not preclude the habitat restoration and trail work contemplated by this plan. Ocean County should consider embarking on a collaborative process with Berkeley Township and Empire Blended Products Inc. to flag, revise and relocate license-rights and survey descriptions precedent to work. The issues involving driveway access to the manufacturing site can be resolved as there is plenty of space within the area to accommodate driveway access and a safe trail corridor for all phases of work. As for the Western Boulevard extension, the current title does not interfere with any proposed design, although we recommend the parties consider how to formally-retire the matter or consider a grant of easement or roadway dedication containing a proper legal description and centerline, as the existing descriptions are misleading and counter-productive.

Eastern edge of mine

SECTION THREE

EXISTING CONDITIONS AND ECOLOGY

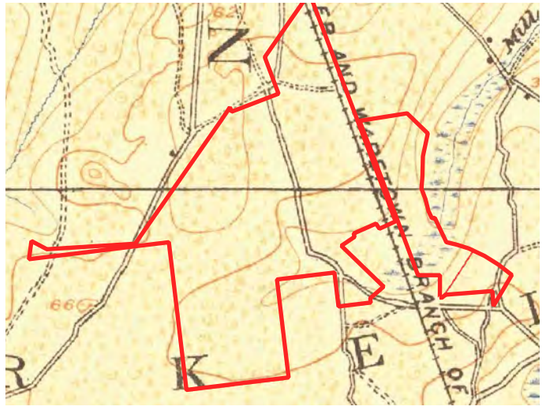
INTRODUCTION

Conditions existing at the Pulverizing site today speak to the mining activities which began in the late-1920s and continued for the next nine decades. Work started near present day Hickory Lane along both sides of the Barnegat Branch rail corridor by removing the top layer of fine sand (silica), thereafter by removal of underlying medium- and course-grades of sand and stone aggregates of varied quality and composition.

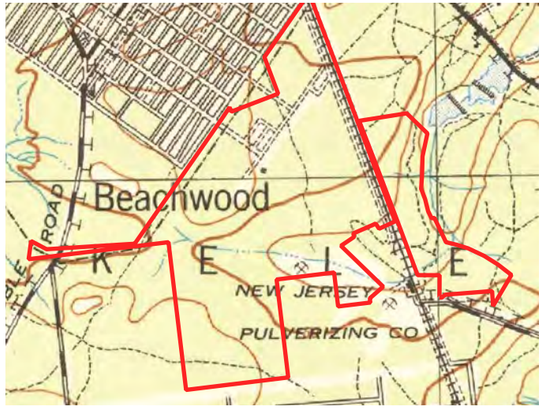
With the exception of a forest perimeter buffer required by local regulations and state mining permits, nearly all the land within the site was mined and substantially lowered in elevation. The result is a degraded bowl-like landscape of exposed compacted soils, revegetated forest and wetland areas, a lake, a network of service roads and remainder soil piles. Based on our analysis of historical topographic maps, mining plans, and soil data, the average floor elevation of the site sits an average of 35 feet below abutting undisturbed land. Volumetrically, this approximates to 108,078,520 cubic feet of excavated material, or enough material to entirely fill one-and-one-half Meadowlands Stadiums (where the New York Giants and Jets play), or 1,250 Olympic-sized swimming pools (50 meters x 25 meters).

Looked at positively or negatively, whatever material was removed from the Pulverizing site and whatever remains is what we must evaluate and plan. Following are discussions of soil and landcover, water infiltration, water quality, fisheries, pollutant loading, and plant communities.

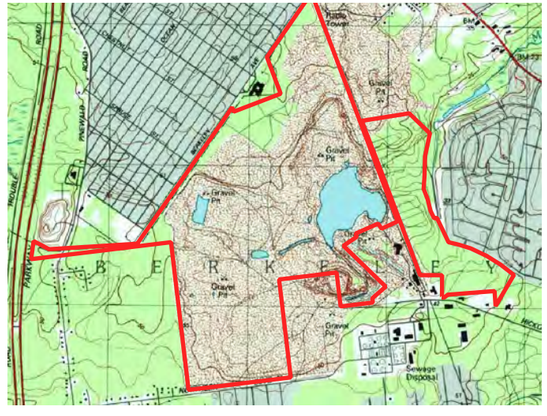
TIME SERIES OF THE FORMER NEW JERSEY PULVERIZING TRACT



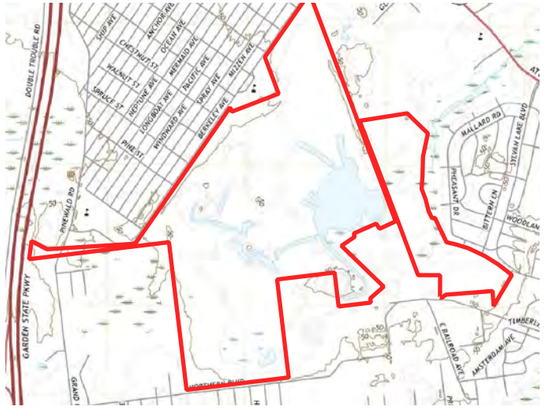
1919



1941



1995



2019

1930

1995

2006

2019

FIGURE 2: *Time series topographic images follow 90 years of extractive work. Note original 1919 contours and rail line prior to excavation and extent of disturbance (1995-2006), appearance of lake and radiating lagoon fingers (2019). Aerial images attest to loss and partial return of vegetative cover.*

A view Southwest over the unimproved Barnegat Branch Railroad corridor and abutting JCP&L power line easement (Courtesy, Ocean County)

TOPOGRAPHY

To the casual observer, the Pulverizing site's topography appears flat and expansive. Up close, however, the site contains significant and subtle elevation changes. These topographic considerations are referenced in and integrated into the design recommendations. In addition, the site sits below surrounding unmined surface grades.

The preponderance of the site's elevation today ranges between 30 and 50 feet above sea level as determined by recent topographic and satellite light detection imagery (USGS, LIDAR, NAVD88). Surface elevations for abutting lands – i.e., lands not excavated such as perimeter buffer and tracts immediately outside the Pulverizing site's boundary – average 20 to 40 feet above the mined elevations. This elevation differential is dually significant: First, the differential attests to the depth of the mining operation and how much material was removed; and, Second, at 782-acres the Pulverizing site presents a significant and unique topographic, bowl-like feature within the regional landscape.

The Pulverizing site has witnessed almost complete alteration. West of the railroad embankment sand and gravel was extracted in vast quantities, including excavation of the deep, extensive pit that presently contains the 42-acre main lake. Much of the same is true for the area east of the embankment in the northeast quadrant closest to Rt. 9 and the former Johnson Manufacturing Plant where the excavation differential is even more pronounced. Excluded from excavation were some high bluffs along Beachwood Borough whose 30 to 50 foot average drop to the mine floor attest to the greater volume of material removed, and a narrow isthmus of land in the south that runs westward perpendicularly to the Garden State Parkway, unmolested so that it could serve as a future entrance-exit to the highway.

A keen eye will come to appreciate how much of the site is dotted by large topsoil piles whose eroded mesa-like formations currently attract ATVs, as well as by multiple depressions such as wetlands, dry basins, and the main lake (that drains into the Mill Creek). Lake bathymetry indicates a depth of 40 feet, so the excavation delta within this area remains doubly significant. The bed of the lake was excavated by an early system of steam-powered, rail-based draglines that operated within the original mining tract. As shown in the photo on Page 16, there are a variety of low depressions where seasonal groundwater sits near or above the surface.

Together, the depressions help to intercept groundwater while capturing precipitation and directing surface flow, generally, toward the main lake. At the very north end of the site, just west of the rail corridor and near the Beachwood border, there exists a large, isolated, topographically-depressed area, which acts as an ephemeral wetland. This area is known for periodic flooding as it was not regraded by the mine owner to direct stormwater to the main lake. It serves as an impoundment during winter and spring rainy periods. While many other depressions within the Pulverizing site drain to the lake via a loose system of roadway culverts, constructed swales and natural depressions, those located along the north end do not, and present a constraint to restoration, trail routing and public safety.

One final note on mine topography. Mill Creek, located to the east of the rail corridor, drains the main lake into the Barnegat Bay at Pine Beach. Historical topographic maps as early as 1888 (See, Figure 2) indicate the presence of Mill Creek and accompanying wetlands west of the rail corridor – now lost to mining. Recent soil mapping indicates that a tributary to this lost segment of Mill Creek extended westward of the site. Although decades of mining and topographic manipulation disconnected this portion of the Creek's natural drainage patterns, an opportunity exists to re-establish the lost segment upstream of the main lake, in addition to improving connections eastward.

In conclusion, mining has dramatically changed site topography and landscape function by removing natural vegetative communities, inducing high infiltration rates, low soil pH nutrient content, low water pH and limited vegetative and microbial productivity within waterbodies involving the main lake, ephemeral streams and wetlands. Some of the changes are irrevocable, but some can be re-engineered and/or reversed under this plan.

GEOLOGY, SOIL, AND LANDCOVER

The ecological characteristics of the Pulverizing site are a function of its geology and its post-mining surface and subsurface soil layer. These factors have significant bearing on the site's restoration, the movement of water – both groundwater and precipitation – and the future success of plant communities within the site's habitat management areas.

The site is located within the Outer Coastal Plain physiographic province of New Jersey, a geologic region consisting of marine deposits of unconsolidated sediments, typically sands, and gravels. According to the New Jersey Geological and Water Survey (**Figure 3**), the surficial geology at the site and the surrounding areas lie primarily within the Cape May Formation, Unit 1 (Qcm1), which has medium sands (coarseness) and pebble gravel containing minor clays, silts, and coarse sands. This remains a thin layer, however, and overlies Sand Facies (Tchs), a component of the well-known Cohansey Formation, the most important aquifer in New Jersey. It is important to note the purple-colored outline in Figure 3, which shows the extent of the former mining area (excavation perimeter).

The deepest existing quarry pit – which contains the main lake today – is mapped as Tchs and represents the earliest known excavation and removal of materials from the site. This formation continues west along the bed of the former Mill Creek which has been entirely lost to mining. It also exists east of the Barnegat Branch Railroad embankment where it was not mined and retains its topsoil and subsoil layers topped by old forest.

Within the creek valley, there are Wetland and Alluvial Deposits (Qals), which consists of fine-to-medium sands and pebble gravel, as well as minor coarse sand, as expected in a valley bottom. Sand and gravel are stream-channel deposits and the wetland deposits are formed by accumulation of organic matter in swamps and bogs. A narrow finger of this formation is mapped immediately west of the Pulverizing site and indicates a remnant channel of a stream that traversed the entire site prior to extractive use. Reestablishment and enhancement of this former stream channel within the disturbed site remains a design goal, and knowing that the corridor exists outside the Pulverizing site is important.

There is also a small sliver of Upper Terrace Deposits (Qtu) pointing back toward the quarry in the stream valley. This unit consists of sand and pebble gravel reaching thicknesses of up to 30 feet. This layer has significant economic value and played a key role in the Pulverizing site's success over the last 90 years.

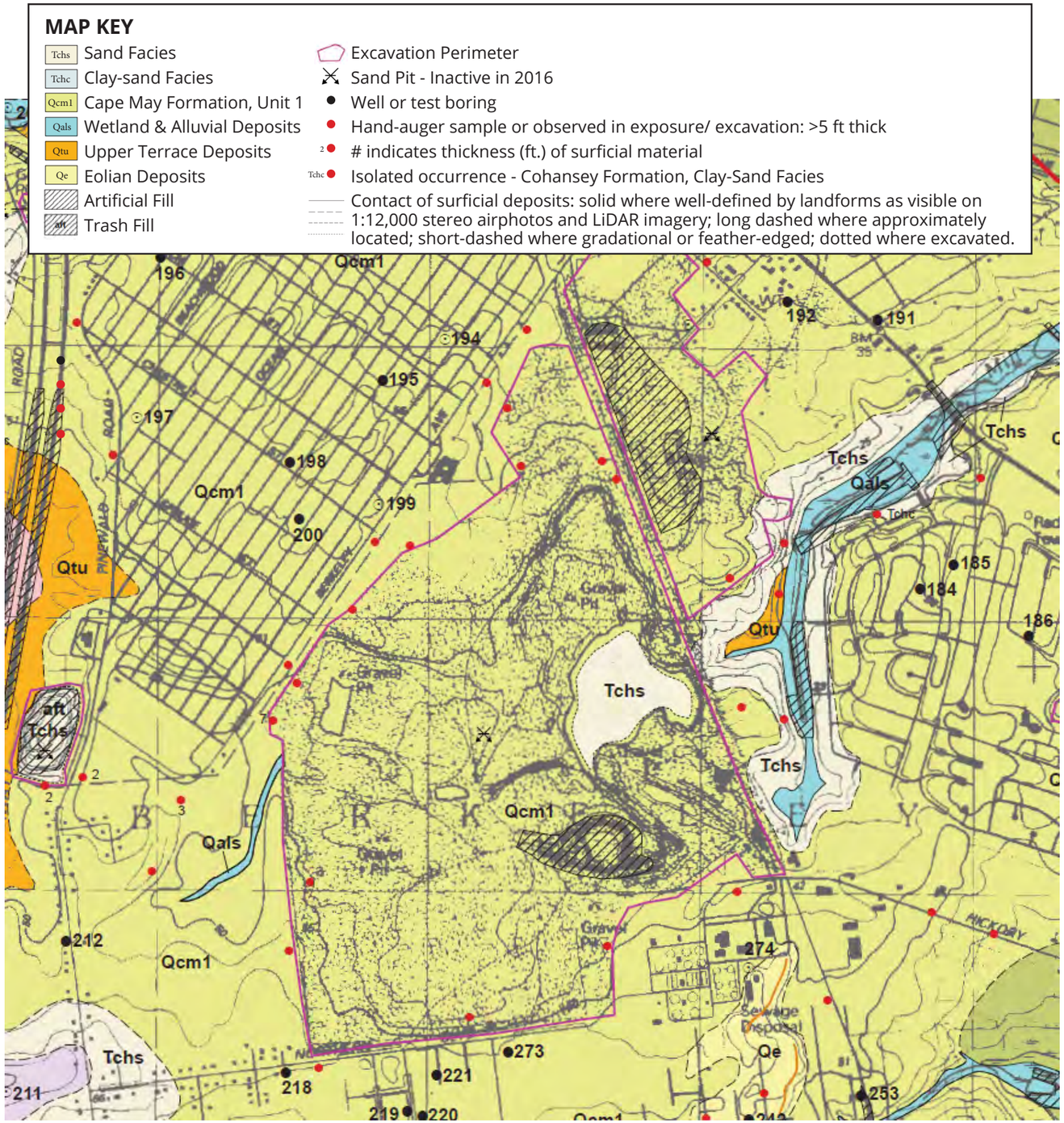


FIGURE 3: *Geology of the Toms River and Seaside Park Quadrangles, Ocean County, NJ [clipped] by Scott D. Stanford and Peter J. Sugarman, NJDEP - New Jersey Geological and Water Survey, 2017*

Geologic zones within the Pulverizing site contain subsoils which further explain the observed hydrology, vegetation, fauna, and topography. Site soils are classified by the USGS as pits, sand, and gravel (PHG) and are centered on the lake and main quarry pit. Other site soils are also recorded, including Woodmansie sand (WobB) is a secondary unit covering a large area along the western border and a barren area to the northeast. Minor soil units included Downer loamy sand (DocBO), Atsion sand (AtsAO), and Manahawkin muck (MakAt) in the Mill Creek corridor to the east, as noted, with minor incursions of Lakehurst sand (LakB) and Lakewood sand (LasB) around the unexploited site perimeter. These soils are generally quite low in nutrients and often extremely gravelly.

As a result, the plant communities colonizing the Pulverizing site are well-adapted to this series of challenging geological and soil conditions. These low nutrient soils also contribute to the low state of vegetative productivity, such as algal growth, within the lake and adjacent wetlands (known as oligotrophic or dystrophic conditions), as well as low in-situ nutrient concentration (See, **Appendix "F"** – Pollutant Loading and Hydrology Analysis). The low nutrient concentrations give rise to acidic, darkly colored waters within the site's southwest quadrant that are rife with organic compounds like tannic acids. The same acidic, low nutrient issues underlie the lack of vegetative productivity in the main lake and give rise to its sterile Listerine-blue color. Acidic conditions are present throughout the site and inform plans for restoration and public access.

Generally, soils within the Pulverizing site are coarse-grained and tend to be moderately to well-drained. This has implications for both groundwater and vegetation. While seasonal precipitation infiltrates these soils and contributes to abundant groundwater, the coarse-grained nature and lack of organic material (due to mining) and surface exposure result in unsaturated zones above the water table, which tend to rapidly dry and create desert-like xeric conditions. This is notable at higher site elevations where dry zones require special treatments ahead of restoration and trail routing. In the lower, wetter areas of the site, the opposite is true. Here, groundwater and stormwater aggregation are important factors in system hydrology and support wetland plant communities and accretion of organic matter.

Denuded ATV washboard area trying to become an emergent wetland, East of the Barnegat Branch Trail (below).

PLANT COMMUNITIES

A survey of vegetation communities within the Pulverizing site is key to restoration design and long-term success. This applies to habitat areas and to the trail system. The site's existing plant communities represent various stages of ecological succession following the cessation of mining activities. Assessing species regrowth, dominance, diversity, and opportunities for future desirable native species is our task, and this begins with a review of the development trajectory for each of the communities identified. Overall, 21.2% of the site is classified as undisturbed communities (165.4 acres) and 78.8% is classified as post-mining communities (616.6 acres). A summary of existing ecological communities appears in **Table 1** (right).

While the Pulverizing site lies outside of the regulated boundary of the Pinelands Comprehensive Management Plan, it does fit within the landscape and ecology of the pinelands as defined by geology, soils, hydrology and dominant plant communities. This project looks to the pinelands to inform habitat design, species suitability and long-term management considerations. For more information on pinelands ecology and habitat for the Pulverizing site, see, **Appendix A – Pinelands Ecology and Habitat Analog**.

Ephemeral wetland East of the Barnegat Branch Trail

TABLE 1: EXISTING ECOLOGICAL COMMUNITY CLASSIFICATIONS

ECOLOGICAL COMMUNITY CLASSIFICATIONS		AC.	PCT.	LOCATION	DESCRIPTION
Undisturbed Communities		***165.4***	***21.2***		
1	Oak-Pine Forest	92.8	11.9	Perimeter	Canopy of pitch pine and oaks including chestnut oak, white oak, and black oak.
2	Pine Forest	17.8	2.3	West	Pitch pine dominated forest, 30-40' high canopy. Characteristic pinelands forest.
3	Oak Forest	37.5	4.8	North, East	Canopy dominated by oaks including chestnut, white and black oak.
4	Hardwood Swamp	14.0	1.8	Mill Creek	Canopy of red maple and black gum with highbush blueberry in the shrub layer.
5	Pitch Pine Lowland	3.4	0.4	West	Small area of this pitch pine dominated forested wetland community.
Post-mining Communities		***616.6***	***78.8***		
6	State Open Water	66.2	8.5	Central, West	Main lake and smaller ponds.
7	Successional Pine Forest	264.5	33.8	Multiple	Primarily pitch pine. Virginia pine, chestnut oak, black cherry, sweet fern present.
8	Emergent Wetland	76.9	9.8	Multiple	Woolgrass, switchgrass, soft rush, water lily, three square, and sundew.
9	Grassland - Old Field	120.2	15.4	West	Switchgrass dominated with scattered young pitch pine.
10	Barren	88.5	11.3	Multiple	Compacted soil areas subject to ATV impacts, little to no vegetation.
TOTAL		**782.0**	**100.0**		

Source: GIS calculations adjusted per recorded survey and conveyance deeds.

EXAMPLES OF ECOLOGICAL COMMUNITIES IN THE FORMER MINING AREA OF THE PULVERIZING SITE

Wetland Adjacent to Finger Lagoon

Emergent Wetland

Emergent Wetland

Grassland

Emergent Wetlands

State Open Water - Main Lake

State Open Water - Small Pond

Emergent Wetland

Grassland - Old Field

Barren

TYPICAL FAUNA OF THE PINELANDS AND BARNEGAT BAY WATERSHED

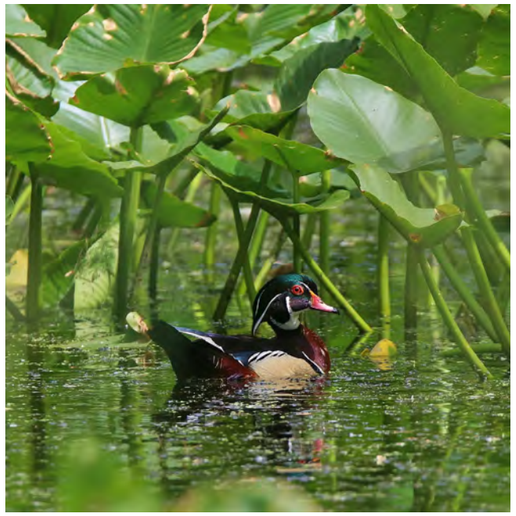
Pine Snake

Great Blue Heron

Eastern Fence Lizard

Eastern Painted Turtle

Chipmunk



Wood Duck

Southern Leopard Frog

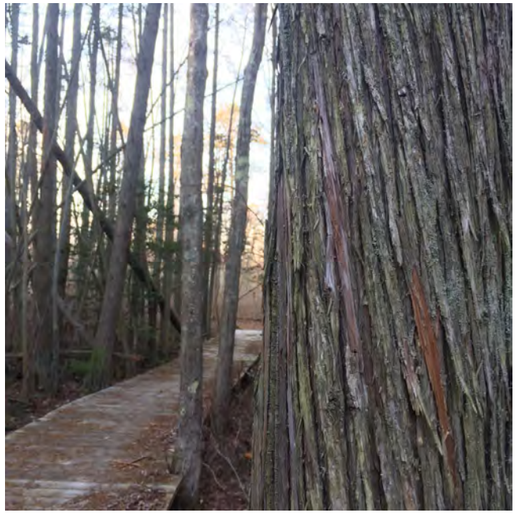
Prairie Warbler

TYPICAL FLORA OF THE PINELANDS AND BARNEGAT BAY WATERSHED

Pitch Pine

Woolgrass

Golden Heather



Atlantic White Cedar

Lady's Tresses

Bayberry

Blackjack Oak

Cranberry

WATER QUALITY

Water quality is an important indicator of ecosystem function as it describes and reflects broader systemic values. Briefly, water quality is a general term that reflects elements of lake ecology and lake science. Water quality measurements typically include temperature, pH, conductance, clarity, dissolved oxygen, nutrient concentrations, biological compounds and flora and fauna such as plankton, macroinvertebrates and aquatic macrophytes.

To assemble sufficient data, a water quality sampling program was initiated on the Pulverizing site over the summer and fall seasons of 2019 and included above-referenced *in situ* measurements, laboratory analysis, plankton sampling and visual surveys of aquatic macrophytes. Sampling was conducted in the main lake, the radiating finger lagoons and some of the smaller ponded features within the site. This is detailed in the Water Quality Sampling Technical Memorandum (See, **Appendix "B")**. The objective was to establish a baseline of conditions across multiple locations. This type of evaluation assists in designing habitat restoration plans that preserve elements considered 'high quality' while developing appropriate habitat restoration measures to mitigate impairments and address the root cause of those impairments. The objective is to create comprehensive environmental enhancement and uplift across the site over time. To our delight, water quality across the Pulverizing site was quite good.

The main lake is *oligotrophic*, meaning the water body contains extremely low nutrient concentrations but abundant oxygen, good clarity, coloration and low pH values – in the low 4s indicating high acidity. Phytoplankton or algae populations, as well as zooplankton that graze on algae, exhibited extremely low density, indicating that the open waters or limnetic areas of the lake have very low biological activity.

Most lake biomass remains concentrated in the relatively shallow littoral areas and include bladderworts (*Utricularia spp.*), a signature pinelands plant that captures zooplankton and other particles in tiny sacs to supplement nutrient assimilation, and Sago pondweed (*Stuckia pectinata*). Benthic macroinvertebrates – a diverse group of insect and insect larvae, worms, mollusks and other organisms that live in sediments – were also extremely limited, though patchy in distribution.

The lake reflects its origin as a quarry pit and lacks complex habitat structure and organic materials. It is not significantly impaired but sits at the extremely low end of the scale for nutrient concentration and acidity. These factors limit observed aquatic flora and fauna within the lake, which currently supports a short list of pinelands-adapted organisms that can meet such harsh conditions. Beneficially, the harsh conditions in the main lake help to limit invasive species. The lake has proven resistant to problems plaguing overfertilized *eutrophic* waterbodies such as algae blooms, fish kills and poor clarity.

As noted, water quality within the main lake and its lagoon system remains good. Habitat restoration and land management activities referenced in Section 4 ("The Plan") have been designed to increase lake diversity and complexity by extending the shallow subsurface shoreline to create a more productive littoral zone. This will benefit the lake and lagoon fishery, expand aquatic species diversity and resilience while maintaining beneficial *oligotrophic* conditions.

The smaller ponds around the site mirror the main lake inasmuch as they contain low nutrient concentrations, dissolved solids and are fairly acidic. The small ponds differ from the lake in that they tend to be quite dark in coloration

Water Lily

Main Lake

Edge of Main Lake

and, as a result, are exhibiting *dystrophic* conditions due to an accumulation of organic materials. This is due to their shallow nature which encourages plant growth such as bladderworts and floating-leaf plants like water lily (*Nymphaea odorata*), little floating heart (*Nymphoides cordata*) along with beneficial emergent wetland vegetation for those areas that feature well-developed edge.

The plant material in these ponds tends to accumulate and contributes to the dark tannic coloration. Macroinvertebrate densities were low in these ponds and plankton were not sampled as the systems were too shallow. Fluctuating water in shallow ponds has limited the development of fish populations. Over time, wetland development will increase around the margins and move inward as organic material accumulates. There are no obvious impairments that require mitigation in these waterbodies, however, they will be similarly limited by low nutrient and high acidity levels and inherent limitations of shallow depth and fluctuating levels. Management should include preservation, enhancement of linked wetlands, and incorporation with other features such as the water trail. The main goal, in terms of water quality management, is to maintain the present quality by maintaining the watershed in a natural state.

FISHERIES

Fisheries are a familiar and valued component of aquatic ecosystems and present an important natural resource and prized recreational opportunity. For the Pulverizing site the existing condition of the fishery was examined through an abbreviated population survey of species composition, size, location, density and life history characteristics. Survey work included taking stock of what exists on the site and identifying the impairments.

Sampling was conducted throughout the main lake, the radiating finger lagoons, and the smaller ponds. Just five species were captured as indicated in **Table 2**, below.

Creek chubsucker, and banded killifish were found at moderate densities in all areas, with the remainder three species at low densities. Four of the five species are native to New Jersey; largemouth bass is not. With the exception of American eel all species appear to be breeding on-site as confirmed by the presence of young-of-year and other small age-classes. Interestingly, and of significance to our restoration plan and design recommendations, American eel breeds in the Atlantic Ocean and matures in inland waters and was the sole migratory species encountered on the Pulverizing site.

Several issues appear to impact the development of the fishery at the site. First, species diversity is poor which is related to the lake's origin as a deep mine pit. Second, the lake has limited connections with other waterbodies, both on- and off-site. While four of the five species are native to the area – and the fifth species is considered naturalized – a broader range of species was anticipated by our field research team.

TABLE 2: FISH POPULATION SURVEY RESULTS

COMMON NAME	SCIENTIFIC BINOMIAL	FAMILY
American Eel	*Anguilla rostrata*	Anguillidae
Banded Killifish	*Fundulus diaphanus*	Fundulidae
Bluespotted Sunfish	*Enneacanthus gloriosus*	Centrarchidae
Creek Chubsucker	*Erimyzon oblongus*	Catostomidae
Largemouth Bass	*Micropterus salmoides*	Centrarchidae

The absence of species diversity and migratory impedance is linked, in part, due to the separation of the main lake from its drainage to the Mill Creek, which flows unimpeded several miles to the Barnegat Bay through a buffered corridor that starts on-site at the east side of the rail embankment. The fishery is also limited due to low system productivity, lack of complex habitat, and poor connection to spawning and nursery habitat. In the ponds dotting the site, blocked or non-existent connections and fluctuating water levels also conspire to limit fish use. These issues are further compounded by drainage infrastructure installed at the low end of the main lake.

The physical separation of the main lake - from Mill Creek and the Barnegat Bay Estuary - was set in-motion a century ago upon construction of the Barnegat Branch Railroad when the Mill Creek was culverted beneath the embankment. The culvert allowed for limited fish passage but things took a turn for the worse when the mine operator subsequently installed a lake drainage riser and grate to control seasonal water levels. Whether this action was completed as a condition of the mining permit, as an aid to dragline operations, or for public safety purposes, we can only guess.

Either way, the existing condition of the fishery at the Pulverizing site requires attention and the proposed improvements are discussed in Section 4. Briefly, a high quality fishery comprised of native species can be developed by improving aquatic organism passage through the reconstruction of the lake's outlet. Additional improvements to lake and lagoon littoral habitat, as well as improving hydrologic connections between the lake and ponds, will benefit the fishery. Finally, as discussed in Section 4, implementing a stocking program and focusing on native pinelands species such as chain pickerel and yellow bullhead will develop a robust fishery with greater abundance, diversity and distribution.

Additional detail is provided in the Fishery Surveys Technical Memorandum (See, **Appendix "C"**).

POLLUTANT LOADING & HYDROLOGY MODELING

Pollutant loading and hydrology modeling of existing conditions was conducted to describe the Pulverizing site's water quality, water dynamics and aquatic ecology. This approach was used in conjunction with and as a complement to the biological sampling. Pollutant loading focuses on the substances, compounds and classes of pollutants typically associated with water quality problems affecting lake ecology, i.e., nitrogen and phosphorus, solids and fecal bacteria. Meanwhile, hydrology modeling collects data depicting localized conditions, responses to single weather events, seasonal patterns and helps determine whether the site shares a common water table elevation, which is important to the restoration of waterways and wetland areas.

Hydrology is calculated at the same time and describes the site's water budget, i.e., precipitation, evapotranspiration and water fluxes via runoff, groundwater flow, and stream discharge. Lastly, modeling helps to explain observed conditions while guiding proposed restoration and mitigation concepts. The Pulverizing site's hydrology is dominated by groundwater and is consistent with high infiltration rates for sand and gravel soils common to pine barrens ecology. Fortunately, runoff proved a minor component of the site's hydrology.

Current conditions for pollutant loading at the site proved extremely low across all modeled parameters. Groundwater was the largest contributor with nitrogen and phosphorus loads, and runoff accounted for about 35 percent of phosphorus. Stream bank erosion along connecting channels contributed most of the solids load. Urbanization along the site's perimeter contributed to nutrient loads at a rate higher than other land uses including commercial and industrial, however, total existing loads remain low.

Overall, pollutant loads remain very low at the Pulverizing site and this contributes to the observed *oligotrophic* and *dystrophic* conditions previously discussed. Therefore, no management of pollutant loads need to occur within the site. If surrounding areas are further developed this could change, however, the site's re-naturalization should help mitigate increased loading. The abundance and flow of groundwater indicates that plans to expand wetlands and open water areas within the site are appropriate and supportable. Groundwater remains a resource that can support the mix of habitat restoration and management objectives.

See, **Appendix "D"** – Hydrology Monitoring
See, **Appendix "E"** – Soil Sampling

Barren area due to ATV use

Edge of Main Lake and future public access area

SECTION FOUR

THE PLAN

PLANNING APPROACH

For Princeton Hydro + Strauss and Associates the approach to this project is not just to develop a management plan for a depleted mining site but to imagine the idea of park within a restored landscape. The core planning problem is how to design and implement a cost-effective program that supports public access and ecosystem objectives established by the Ocean County Natural Lands Trust. Throughout the project's analytical stage we learned that this project portends 'great value' and 'enormous upside potential.'

Ocean County has taken possession of a sterile and moon-like landscape. With implementation of this plan, the County will begin a process of moving things around; of forming connections; of allowing life to move in such as: Water. Wetlands. Grassland. Trails. People. Bicyclists. Birders. Hikers. Fishermen. Kayakers. Forests. Jump start nature. Curb ATV use. Give the site time for nature to finish the work.

PLAN ORGANIZATION & MAPS

The plan for the Pulverizing site is based on a vision that is derivative of two overarching goals: First, provide ecological uplift; and Second, provide passive recreational public access. The plan's design recommendations utilize two ecological approaches – habitat creation and habitat preservation – and a public access mandate.

Note: All habitat maps and trail routing plans shown on the following pages are conceptual and should not be read with fixed, absolute, and permanent boundaries. Large portions of the Pulverizing site allow for adaptable design; habitat areas can be expanded, reduced, merged, or simply left alone. A number of trails can be relocated pending habitat area plans and construction phasing.

We have organized this section and design sub-classifications accordingly:

A. PUBLIC ACCESS

1. Land Trails for Pedestrian and Bicycle Access
2. Water Trail for Kayak and Canoe Access
3. Lakeshore Public Access Area
4. Parking and Embarkation

B. HABITAT CREATION

1. Fishery Habitat
2. Connecting Waterways
3. Emergent Wetlands
4. Bog
5. Ephemeral Wetlands
6. Grassland
7. Outlet Stream Connection
8. Successional Woodlands

C. HABITAT PRESERVATION

1. Successional Pine Forest
2. Mature Forest
3. Wetlands and Open Waters

TABLE 3: PROPOSED PUBLIC ACCESS, HABITAT CREATION, AND PRESERVATION AREAS

LAND USE		AC.	PCT.	LOCATION	COMMENTS
A - PUBLIC ACCESSS		**3.8**	**0.4**		
1	Parking and Embarkation	1.3	0.2	South	Main area located off Hickory Lane - Segal Avenue.
2	Multi-use Trail + Foot Paths			Multiple	Total: 9.5 mi. (2.6 mi. multi-use + 5.5 mi. foot paths + 1.4 mi. BBT).
3	Kayak + Canoe Trail			Multiple	Total: 4.0 mi. (3.1 mi. connecting waterways + 0.9 mi. lake circuit).
4	Lakeshore Access Area	2.5	0.3	Central	Includes open shoreline and fishing access peninsulas
B - HABITAT CREATION		**264.0**	**33.8**		
1	Fishery Habitat	2.5	0.3	Central	Enhance fish habitat along eastern shoreline of the main lake.
2	Connecting Waterways	8.0	1.0	Central	Extend open water via 5,151 linear feet of new channels.
3	Emergent Wetlands	57.7	7.4	Central	Create along main lake and connecting waterways.
4	Bog	10.6	1.4	Southwest	Multiple enhancements, See Section 4, Item B, Para. 4.
5	Ephemeral Wetlands	37.9	4.9	Multiple	Improve hydrology and acreage seasonal flooded wetlands.
6	Grassland	124.5	15.9	West	Create grassland dominated by warm season grasses.
7	Outlet Stream Connection	0.9	0.1	East	Reconnect the main lake to Mill Creek.
8	Successional Woodlands	22.0	2.8	Multiple	Create where fast-growing woody plants are needed.
C - HABITAT PRESERVATION		**514.5**	**65.8**		
1	Oak-Pine Forest	92.8	11.9	Perimeter	Canopy incl. chestnut oak, white oak, black oak and pitch pine.
2	Pine Forest	17.8	2.3	West	Pitch pine dominated forest, 30-40' height w/canopy.
3	Oak Forest	37.5	4.8	North, East	Canopy dominated by oaks including chestnut, white and black oak.
4	Hardwood Swamp	14.0	1.8	Mill Creek, East	Canopy of red maple, black gum w/highbush blueberry shrub layer.
5	Pitch Pine Lowland	3.4	0.4	West	Small forested wetland community dominated by pitch pine.
6	Open Water	66.2	8.5	Central	Primarily main lake, adjacent channels and ponds.
7	Emergent Wetland	18.7	11.9	Central	Wetlands along pond.
8	Successional Pine Forest	264.3	33.7	South	Large area in various stages of recovery.
	TOTAL	**782.0**	**100.0**		

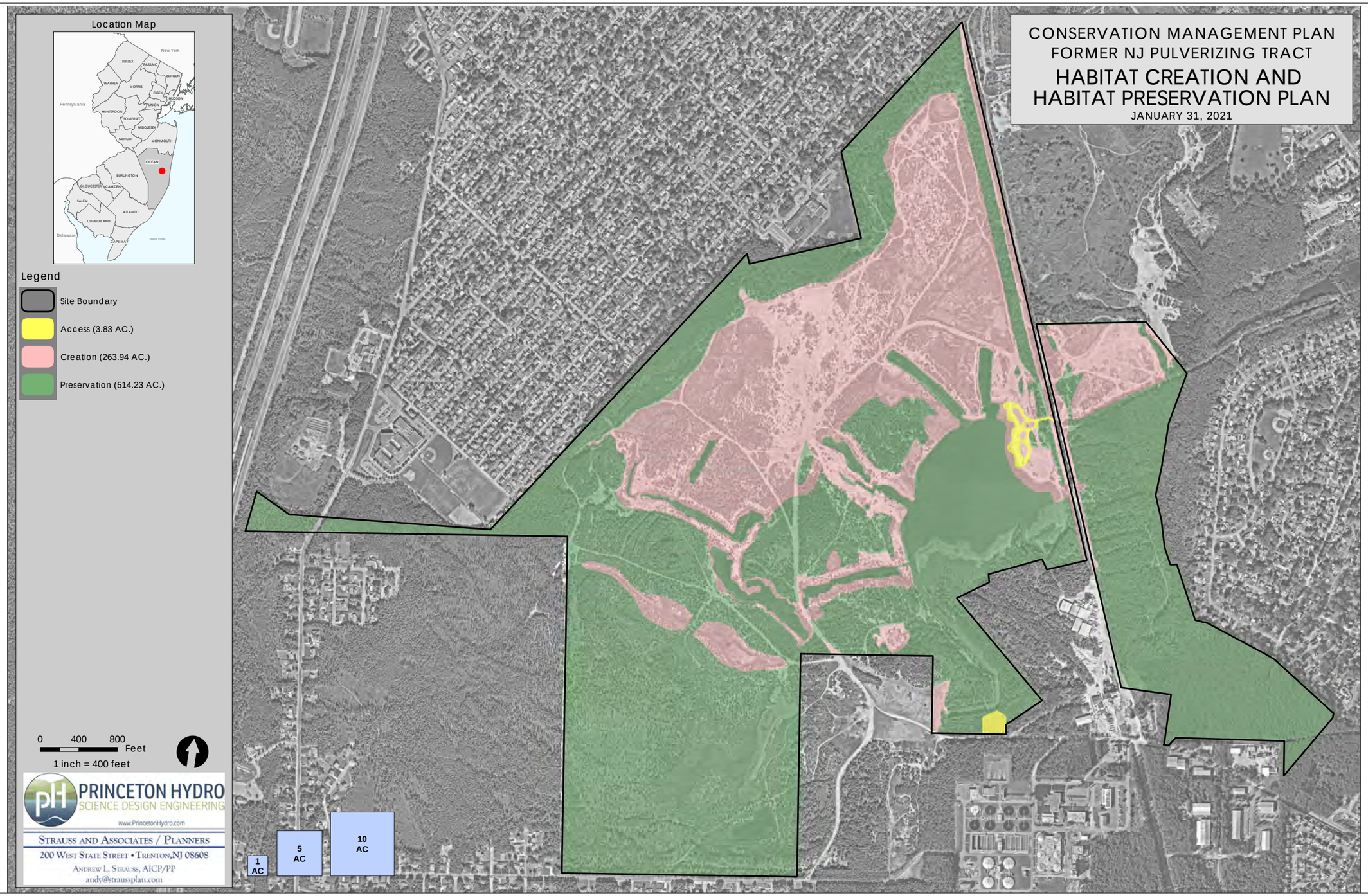


FIGURE 4: *Habitat Creation and Habitat Preservation Plan*

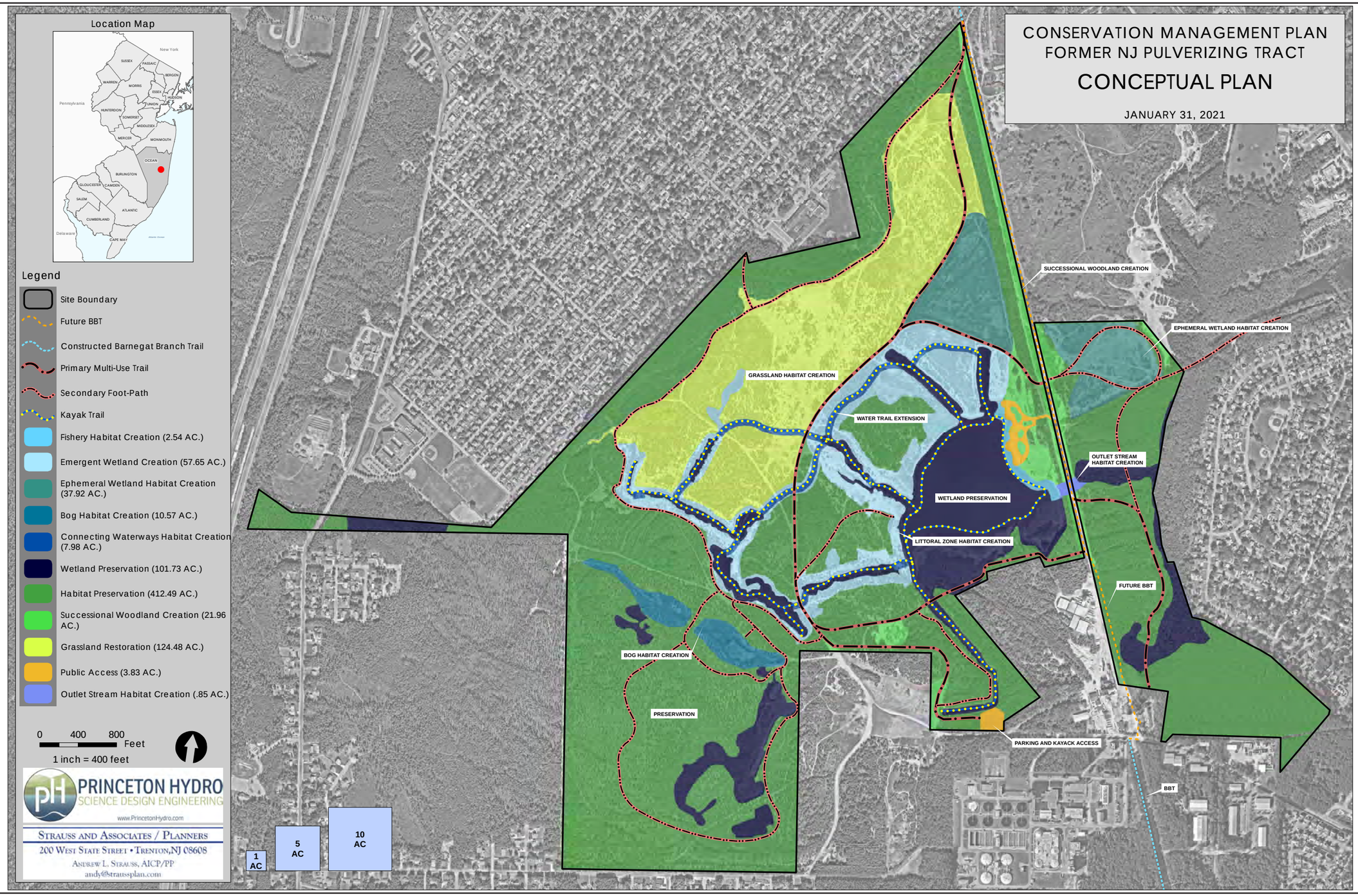


FIGURE 5: *Conceptual Conservation Management Plan*

A. PUBLIC ACCESS

A. PUBLIC ACCESS | **B. HABITAT CREATION** | **C. HABITAT PRESERVATION**

1. Land Trails for Pedestrian and Bicycle Access
2. Water Trail for Kayak and Canoe Access
3. Lakeshore Public Access Area
4. Parking and Embarkation

INTRODUCTION TO PUBLIC ACCESS

Increasing public access to – and throughout – the site serves as a key objective for the design of habitat creation and habitat preservation areas. Conversely, long-term restoration within the Pulverizing site requires a commitment to curtailing illegal ATV trespass that has damaged, and continues to threaten portions of the site. The public access program is intended to bring visitors to the site through an extensive system of constructed trails, connected waterways, fishing access, wetland-protected, and open water which will attract a cohort of users, and will place large numbers of eyes and ears 'on-the-ground' each and every day. As reviewed in this section, a phased system of parking and access control will be linked to miles of new multi-use trails (linking the site to the Barnegat Branch Trail), connecting waterways, kayak trails, fishing access at newly-constructed peninsulas, and a lakeshore access area designed as a public commons.

1. LAND TRAILS FOR PEDESTRIAN AND BICYCLE ACCESS

FEATURE: The first phase of site development calls for a system of multi-use trails and secondary foot paths for bicycle and pedestrian access. The trails and paths will utilize existing and newly-created ways, and will connect the embarkation area with a range of interesting features. Multi-use trails will be constructed to the standard used for the Barnegat Branch Trail with a compacted sub-base, base, and rolled granite stone dust surface of 10-feet in width suitable for year-round use. These trails will be ADA-accessible. The trail surface drains well and has proven firm, fast, and capable of supporting bicycles, strollers, wheelchairs and approved personal mobility devices, in addition to maintenance and emergency vehicles. A narrower secondary foot path system will be designed to access habitat preservation and creation zones. Secondary trails shall be designed principally for pedestrian use featuring a six-foot-wide maximum cartway finished in compacted soil or sand, and utilizing transitional segments finished with granite stone dust, composite, wood corduroy or boardwalk depending on slope, drainage, and related wetland or aquatic conditions. Many of these trails will be ADA-accessible, however, certain areas of challenging topography (steep slopes, seasonal wetlands or bog areas) may have limitations; a system of all-season paths will be mapped.

GOAL: The land trails will be the primary means of public access to the Pulverizing site's unique and varied habitats. Trails have been designed in a circumferential fashion, radiating north from the parking area yet meandering in a curvilinear fashion through the site. Trails have been designed with several goals, including the elimination of long, uninteresting linear segments and will be graded, sloped and revegetated to maximize perimeter forest growth, forest canopy and summertime shade. The Multi-use Trail runs 2.6-miles total, and the many Foot Paths incorporate an additional 5.5-miles (See, plan). Separately, the Barnegat Branch Trail will run 1.4-miles through the site.

ACTION: A conceptual layout for the trail system including parking access, a hierarchy of primary and secondary routes – including a spur of the Barnegat Branch Trail – bridge design, right-of-way adjustments, grading, decompaction and revegetation is shown on the next page. The County will be responsible for preparation of preliminary and final engineering, including permitting and construction. At least four bridges over existing and proposed waterways will be required to complete the system. Trails should not be opened until all Phase I site improvements are complete, including excavation of interior waterways, lakeshore and riparian area enhancements and completion of the water trail system.

STEWARD: Trail design, permitting, and construction is typically managed by the County Engineering and Planning Departments with input from the Parks and Recreation Department. Once the trail is placed in-service, operation and maintenance remain the responsibility of Ocean County. Key activities include rolling and supplementing granite stone dust surface fines to stave-off vehicular rutting – due policing and use by maintenance equipment – and management of vegetated slopes to prevent trail erosion and planting and periodic pruning of the tree canopy.

Barnegat Branch Trail Sign

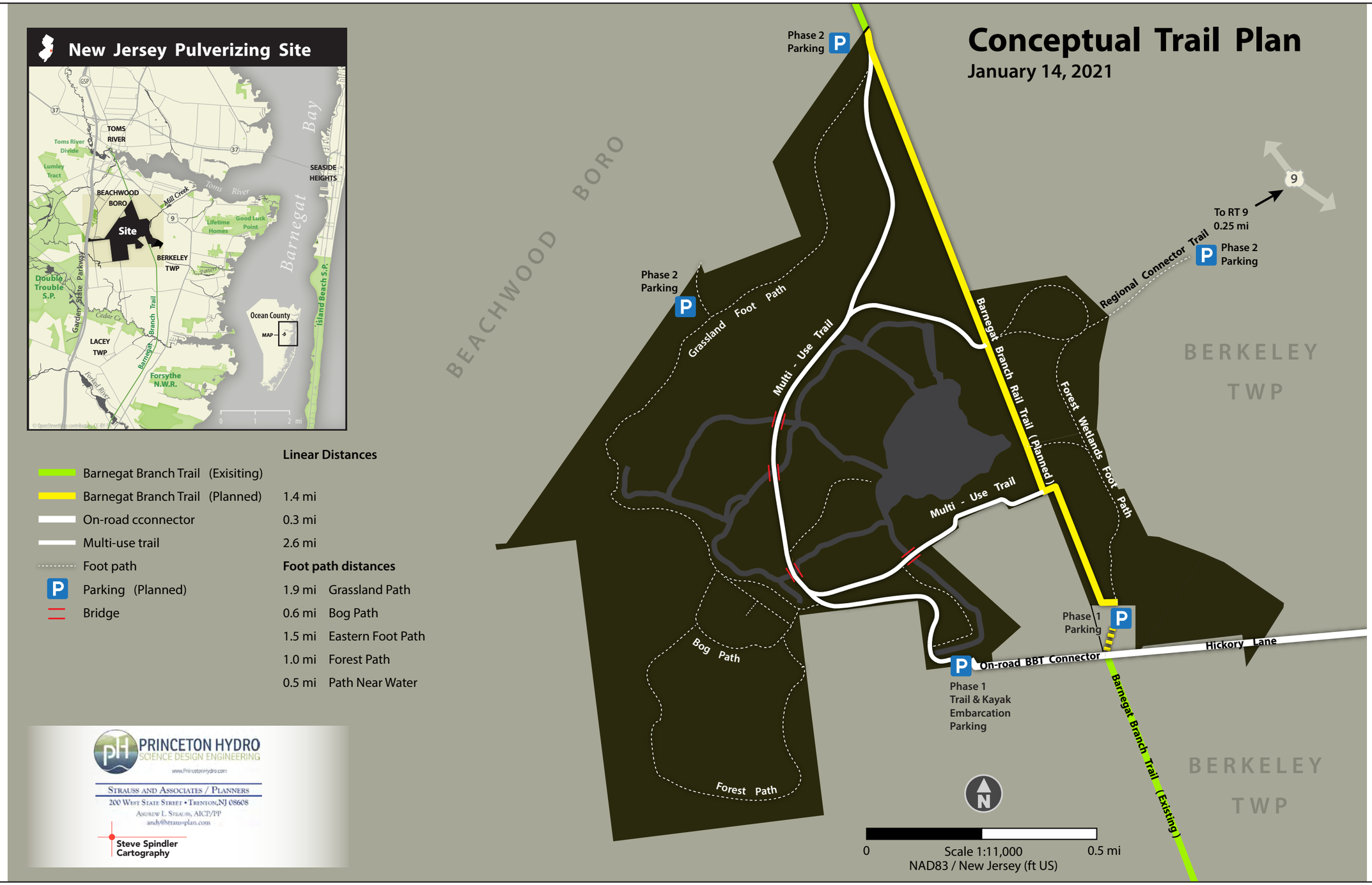


FIGURE 6: *Proposed routing and connection of the multi-use trail with the Barnegat Branch Trail, in addition to routing of foot paths linking the site's many habitat areas. Once complete the Pulverizing site will offer more than 10-miles of improved trails for public use, with many miles of unimproved trails.*

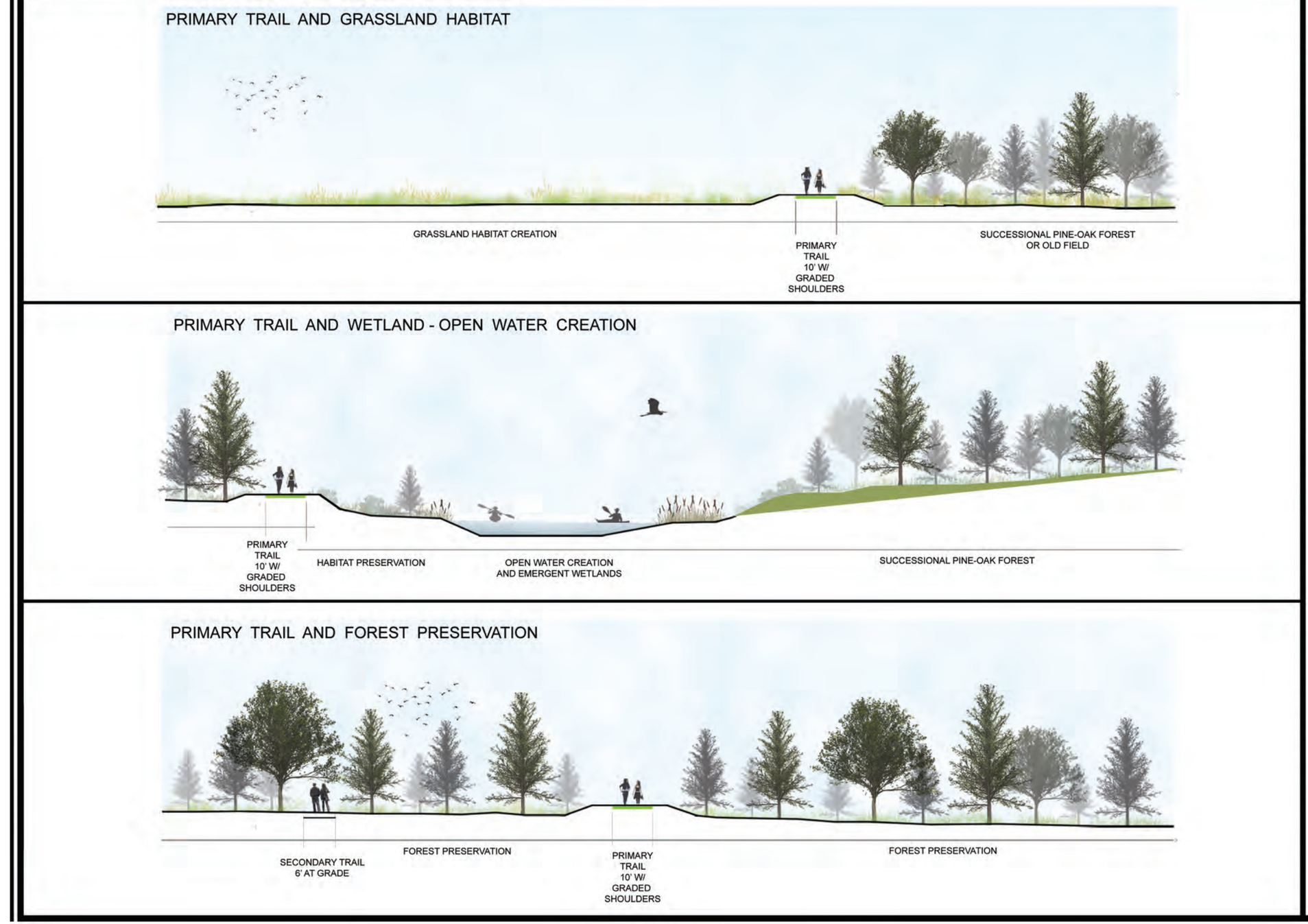


FIGURE 7: *Three cross-section views of the multi-use trail and foot path in different habitat areas. The multi-use trail will be designed to a width of 10-12 feet and ADA accessible, and will be elevated for improved views and drainage. The foot paths will be sited at-grade to take advantage of wetland, grassland and forest habitat.*

2. WATER TRAIL FOR KAYAK AND CANOE ACCESS

FEATURE: The primary active recreational water feature at the Pulverizing site will be construction of a water trail for kayak and canoe access. The trail is not a matter of plotting a line through the lake to terminal finger lagoons. Rather the water trail connects 3.0 miles of waterways and new channels to link existing open waters of the main lake (with an additional mile of circumferential paddling), the radiating finger lagoons, and blackwater ponds. This network of open water will allow for miles of continuous travel, along with access to new shoreline habitat. Similar to the land trail system, the water trail will allow users to transit through the site's habitat areas. Accessible waters include the 42-acre main lake, shallower year-round interior waterways and passages, and a variety of shallow freshwater wetlands.

GOAL: The water trail will give paddlers the opportunity to circulate for hours through new loops and courses whose interconnections eliminate current one-way, dead-end journeys. The trail will provide paddlers with access to new and distant habitat areas. Friends and families can utilize modal connections for picnics; parents can bike while the kids can paddle to prearranged picnic areas. Creation of emergent wetland and shoreline habitat adjacent to the water trail will enhance access for wildlife observation and fishing. As configured, the water trail is designed to utilize, to the greatest extent practical, existing water features; new connecting waterways will comprise a low percentage of the trail length. The water trail will be constructed to minimize disturbance of important habitat and will parallel segments of the land trail network.

ACTION: A conceptual layout for the water trail system shows areas for excavation, including a spur connecting to the parking and embarkation area at Hickory Lane. The spur will facilitate cartop launch at this location and will serve as the Pulverizing site's (initial) point-of-vehicular access. Construction of the water trail involves excavation of 5,150 feet of new channels and deepening of existing channels. As fluctuations in lake level and site hydrology are anticipated – especially during summer and fall -- the system's design depth will be set to accommodate low water. The water trail would be placed in-service upon completion of Phase I site improvements including major construction required for the bicycle and pedestrian trail network, the fishery and emergent wetland habitat, terrestrial habitat areas, the Hickory Lane parking and embarkation area, and the ranger station and maintenance shed proposed for the lakeside public access area.

STEWARD: Once placed in-service, water trail operation and maintenance will become the responsibility of Ocean County. Periodic channel dredging and seasonal removal of aquatic vegetation by mechanical device or herbicides should be anticipated.

Connections to the main lake, radiating finger lagoons, and blackwater ponds will allow for miles of continuous kayaking.

The water trail will provide paddlers with access to new habitats for fishing and wildlife viewing.

FIGURE 8: *Proposed routing and connection of the kayak and canoe trail. Completion of the water trail requires excavation of 5,150 feet of connecting waterways and will result in 3.0-miles of backcountry paddling, with access to wetland and upland habitat areas.*

3. LAKESHORE PUBLIC ACCESS AREA

FEATURE: The Public Access Area is envisioned as the principal shoreline recreational gathering location within the Preserve. Situated along the northeast shore of the main lake, and currently used informally as a defacto trespass and party beach, the proposed public access area is designed to accommodate passive recreational activities such as swimming, picnicking, birding, and fishing. The area is readily accessible via the Barnegat Branch Trail and the water trail and will contain additional habitat creation elements, notably peninsulas for viewing and fishing. The lakeshore will be modified to enhance fishery habitat with constructed coves, fish-attracting structures set within deep and shallow waters. Along the beach a series of habitat islands consisting of successional shrub and woodland areas to improve the beach zone's habitat value. Small patches of preserved pine forest will further enhance the natural setting.

GOAL: The plan elevates this area as the Preserve's public commons, an intended node of activity with heavy visitation during the warm season and especially over summer weekends. Since vehicular parking is situated more than 2,000 feet to the south, visitors will arrive under their own power: bike, foot, kayak and canoe. The plan recommends that Ocean County locate a ranger station and maintenance shed (controlled access via the Barnegat Branch Trail) within the trail right-of-way overlooking the shoreline. Staffing will assist with crowd management while providing central access for managing and securing the interior trail network and habitat areas. The question whether utilities are extended to the station remains; for short-term cost control a rooftop solar installation and self-mulching toilets can be installed. Existing steep and dangerous subsurface slopes – the remnants of mine operations – will be improved by decreasing the slopes through a combination of filling with excavated soils generated as a result of the construction of a shallow safety bench bordering the pond.

ACTION: A site plan and preliminary grading plan should be developed ahead of preliminary engineering and permitting. Passive use areas along the lakeshore must be designed and several actions are required including the removal of post-mining debris, removal or stabilization of soil stockpiles, regrading, decompaction and stabilization of ATV damaged areas followed by a planting design for fast-growing successional woodland species. Fishery habitat will be designed and built by creating a series of coves and shallow benches to improve fish habitat along the lake edge and by using the excavated sands to create peninsulas to provide fishing access to the lake.

STEWARD: This area will require significant investment for short- and long-term maintenance. On the human side, insuring civility and a beneficial lakeside visitor experience is essential and new County staff positions may be necessary. From a capital perspective, habitat creation and maintenance along the lakeshore Public Access Area will realize the highest probable unit cost expense vis-à-vis improvements planned elsewhere within the site.

Coves and shallow benches will create fish habitat along the lake edge.

Solitary Sandpiper (Tringa solitaria)

PRINCETON HYDRO
SCIENCE DESIGN ENGINEERING
www.PrincetonHydro.com

STRAUSS AND ASSOCIATES / PLANNERS
200 WEST STATE STREET • TRENTON,NJ 08608
ANDREW L. STRAUSS, AICP/PP
andy@straussplan.com

NOTES:
1. Map Projection: NAD 1983 StatePlane New Jersey FIPS 2900 Feet.
2.Site boundary obtained from Ocean County Department of Planning.
3. 09/28/2019 aerial obtained from Nearmap.

0 75 150 Feet

PUBLIC ACCESS

FORMER NJ PULVERIZING TRACT
BERKELEY TOWNSHIP
OCEAN COUNTY, NEW JERSEY

FIGURE 9: *The proposed Public Access Area will provide access to the lake from the Barnegat Branch Trail with new fishing opportunities and create a naturalized area by establishing native vegetation.*

4. PARKING AND EMBARKATION

FEATURE: The first phase of site development calls for parking and site access to be concentrated at a single, large, gated lot located along an extension of Hickory Lane / Segal Avenue. Additional parking areas may be developed under the Barnegat Branch Trail program. This lot will provide the only access to the site for pedestrians, bicyclists and water trail users. The embarkation area will feature parking for 35 vehicles with room for expansion, restrooms, a shaded picnic grove, kayak racks, a boat ramp, an orientation pavilion housing maps, aerials and interpretative panels and a County operations and maintenance structure. The parking area will be located 1,600 feet west of the intersection of Hickory Lane and East Railroad Avenue where the Barnegat Branch Trail currently terminates. An on-road connector to the Barnegat Branch Trail will be extended west from its terminus to – and through – the parking area where it enters and meanders through the Pulverizing site, ultimately connecting to the mainstem Barnegat Branch Trail at the central point of the site to continue the journey north through Beachwood to Toms River.

GOAL: All land and water trails will radiate from the parking area will provide visitors with convenient, seamless access to the site. In order to limit ecological disturbance beyond the main parking area, the Pulverizing site will be designed to accommodate only non-motorized access. All vehicular-based embarkation of pedestrians, bicyclists and kayakers will initially be concentrated at this location. Future options for additional parking in the north and east will be based on future site development and co-development of the Barnegat Branch Trail and trailheads. The subject embarkation area will contain space sufficient to accommodate peak full-day visits and future expansion.

ACTION: A conceptual layout for the parking area, including trail access, facilities, grading and extension of utilities and public road access is shown below. The County will be responsible for preparing preliminary and final engineering for permitting and construction. The parking area should not be opened until Phase I improvements are completed, including excavation of connecting waterways, creation of emergent wetlands, fishery creation and construction of intersecting segments of the land trail system, including the Barnegat Branch Trail connection north (through the site) to Beachwood.

STEWARD: Operations and maintenance of the parking area, including design and utilization of all structures and materials storage will be the responsibility of Ocean County.

Parking and Embarkation Area

Future Embarkation Area

PRINCETON HYDRO
SCIENCE DESIGN ENGINEERING
www.PrincetonHydro.com

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andy@straussplan.com

NOTES:
1. Map Projection: NAD 1983 StatePlane New Jersey FIPS 2900 Feet.
2. 09/28/2019 aerial obtained from Nearmap.

PARKING AND EMBARKATION AREA

FORMER NJ PULVERIZING TRACT
BERKELEY TOWNSHIP
OCEAN COUNTY, NEW JERSEY

0 20 40 Feet

FIGURE 10: *Located off Hickory Lane the proposed parking and embarkation area will provide public access to land and water trails, and incorporates 35 spaces with additional trailer parking, picnic pavilions, restrooms and a kayak-canoe launch. Additional parking and trailhead areas will be developed in several phases.*

B. HABITAT CREATION

A. PUBLIC ACCESS

B. HABITAT CREATION

C. HABITAT PRESERVATION

1. Fishery Habitat
2. Connecting Waterways
3. Emergent Wetlands
4. Bog
5. Ephemeral Wetlands
6. Grassland
7. Outlet Stream Connection
8. Successional Woodlands

INTRODUCTION TO HABITAT CREATION

For definitional purposes habitat creation is an inclusive term that combines habitat restoration and habitat enhancement. Habitat creation at the Pulverizing site applies to any area modified to succeed ecologically. Areas receiving treatment under the creation rubric include the main lake and shoreline, wetlands (permanent and ephemeral), land denuded and compacted by ATV trespass , establishment of new grasslands, as well as projects designed to improve aquatic connections (connecting waterways, stream passages, and regrading initiatives). Creation areas will be planted and seeded with species indigenous to the pinelands with some areas mimicking historic habitat types while other areas – such as the grassland – are proposed as entirely new to this site but consistent with other grassland communities located within the pinelands (see, "**Appendix H**").

This section contains eight separate creation projects: fishery habitat, connecting waterways, emergent wetlands, bog, ephemeral wetlands, grassland, outlet stream, and successional woodlands.

1. FISHERY HABITAT

FEATURE: Fishery habitat creation is focused on creating a complex shoreline habitat of jutting headlands and peninsulas interspersed by constructed coves along the main lake. These enhancements are designed to improve shoreline access for passive use and observation, including access for anglers and birders. The area will be enriched with fish-attracting structures and plantings and will be designed to allow access to deep-water areas.

GOAL: While providing lakeshore access and habitat improvements for fish, the creation of a nearshore bench will serve as a safety feature inasmuch as current underwater shoreline drop-offs are steep and dangerous. As a design objective, nearshore littoral zones are important to the ecology as they directly support almost all the biomass of the system including plants, algae and fish. Currently, low nutrient concentrations in the lake limit biomass and ecological complexity is due to a lack of habitat features, including woody material. Modifying these areas will result in a more robust fishery and a safe, improved user experience.

ACTION: Lakeshore enhancement actions combine 'cut and fill' construction to establish new subsurface depths sloping to seven feet. The slope will support new aquatic vegetation. Shallow littoral shelves are limited around the shoreline and many of the banks and side slopes remain exceedingly steep. Expanded areas will include peninsulas, while the intervening coves will make use of woody material salvaged from cleared successional forest areas and used as fish attractants. Revegetation is expected to occur naturally. Establishment of plants and by fish will be rapid and fully-functional within a short time and habitat quality will improve as organic matter builds. Improved aquatic organism passage achieved through reconstruction of the outlet pipe under the Barnegat Branch Trail embankment will reconnect the lake with Mill Creek and the Barnegat Bay Estuary, allowing for lake and wetland recolonization by native species.

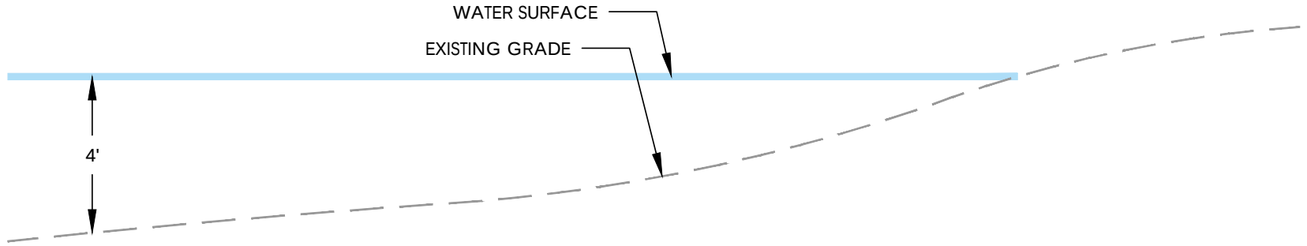
STEWARD: Management may include periodic additions of new woody habitat features although decay rates should be low. Planting may be desirable alongside harvesting and/or herbicide application as required to limit growth of nuisance species. A stocking program focused on native pineland species such as pickerel and bullheads, should be considered.

A Great Egret fishing for dinner.

Future fishing access area

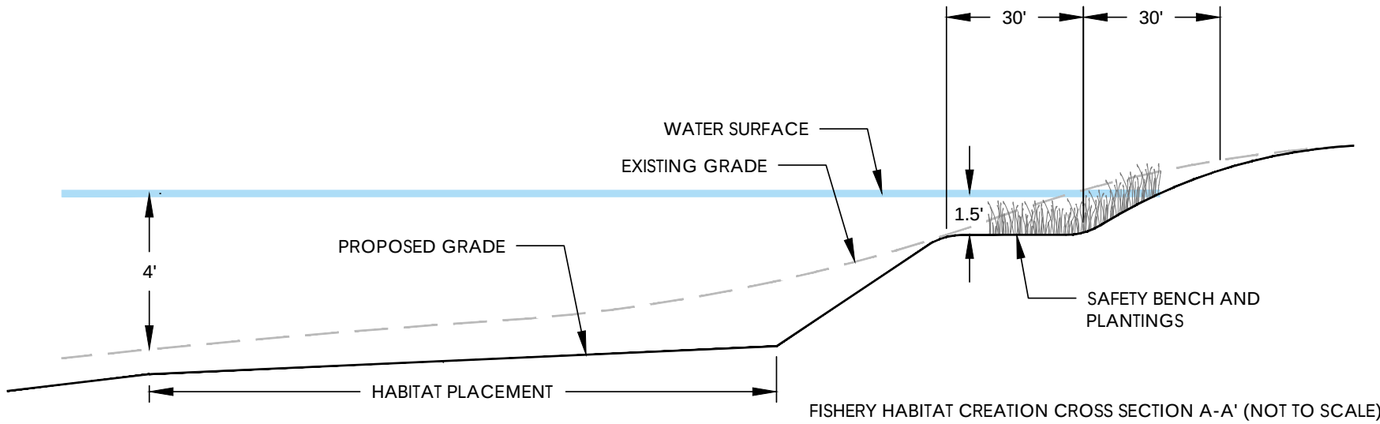
FIGURE 11: *Through strategic shoreline modification and the placement of recycled Christmas trees and woody material in the lake, fishery habitat will be created.*

EXISTING PLAN VIEW

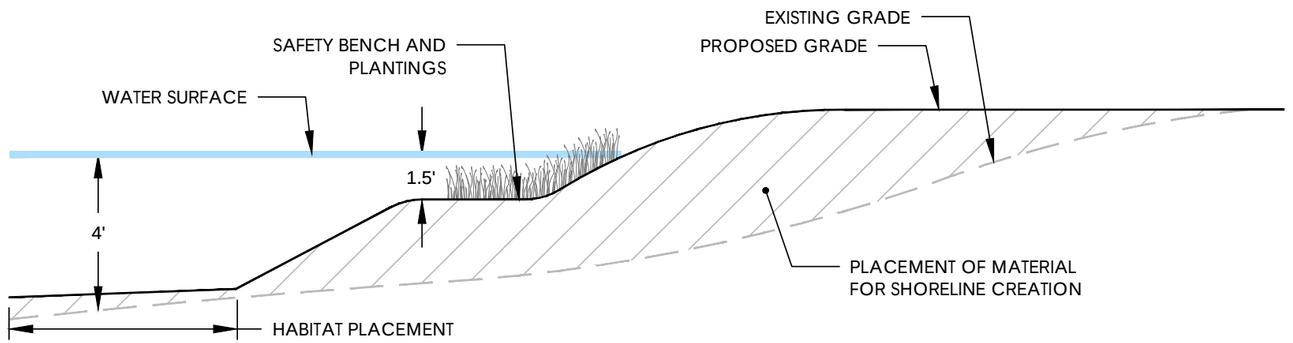


EXISTING CROSS SECTION VIEW X-X' (NOT TO SCALE)

PROPOSED FISHERY HABITAT CREATION PLAN VIEW



FISHERY HABITAT CREATION CROSS SECTION A-A' (NOT TO SCALE)



FISHERY HABITAT CREATION CROSS SECTION B-B' (NOT TO SCALE)

FIGURE 12: *By regrading the shoreline to create peninsulas and coves and installing woody material salvaged from the site, this plan transforms the current sterile lake into a robust fishery and safe user experience.*

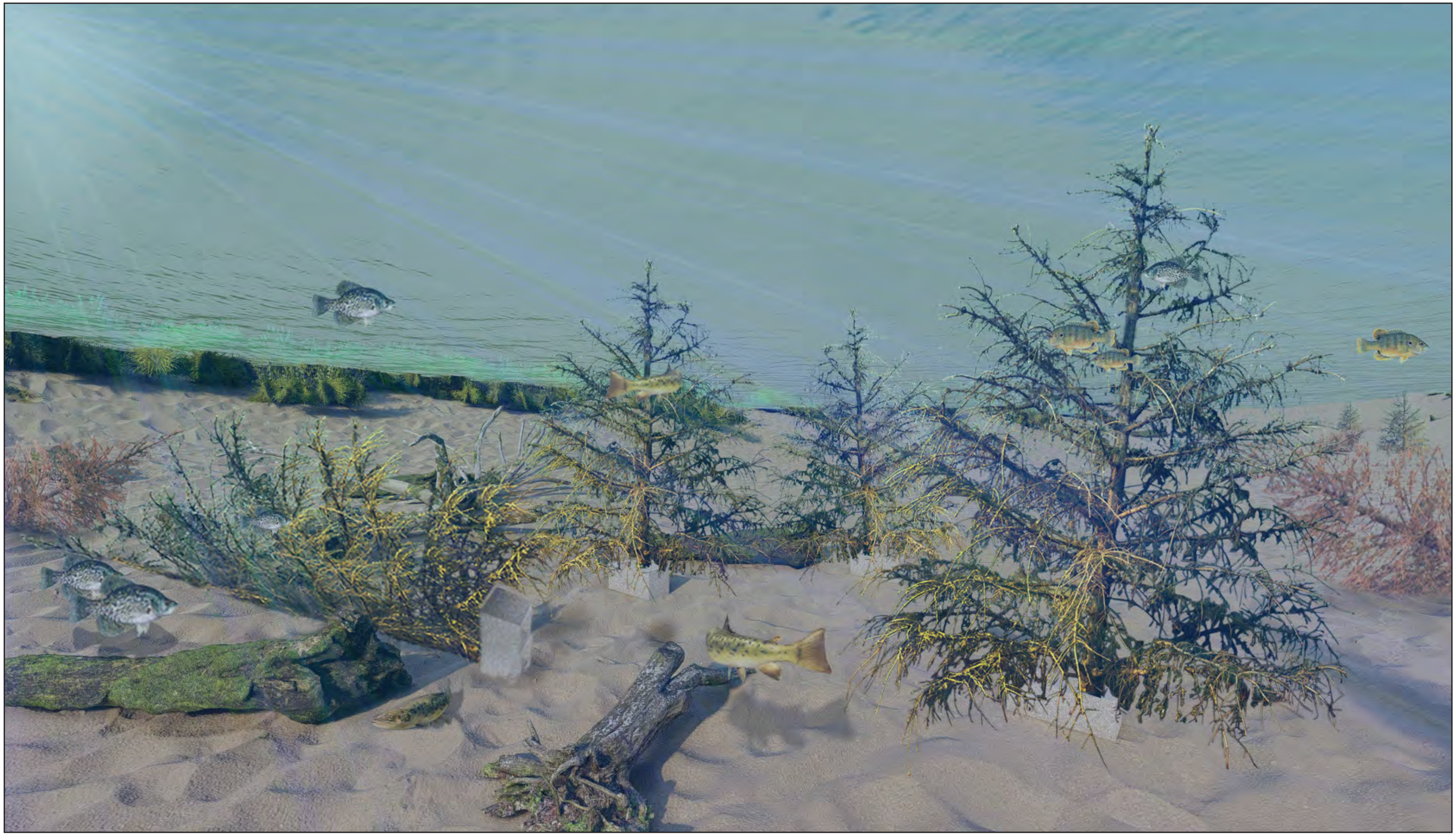


FIGURE 13: *This is a representation of how the use of recycled Christmas trees and salvaged woody material from other parts of the site will create fish habitat along the shoreline of the Public Access Area.*

2. CONNECTING WATERWAYS

FEATURE: The 42-acre main lake and multiple radiating finger lagoons are the result of mining operations and, arguably, represent the central visual feature of the Pulverizing site. The enhancement of the lake and dead-end lagoons are key creation features of this plan. For lake's terminal finger lagoons, the plan calls for a system of newly excavated waterways which connect the lagoons to one-another and to small ponds as well as to the site's varied habitat, public access areas, and trail nodes. For the lake, the plan calls for a comprehensive program of shoreline restoration. Presently, the main lake is a deep waterbody that is oligotrophic (lacking nutrients, containing a high pH and low level of aquatic life) while the small ponds are characterized as dystrophic (nutrient rich, maintaining low pH and low level of aquatic life, as well). In contrast to the lake, several of the small ponds possess the brownish tea-colored water characteristic of pinelands surface waters. The tea-colored appearance is the result of high levels of iron, tannins (natural compounds derived from decaying vegetation), and undecayed plant materials. It is anticipated that as the emergent wetlands planned along the connecting waterways mature, they too will develop the natural tea-color. All of the terminal lagoons and small ponds that will be connected all currently possess populations of fish which will be enhanced by this plan.

GOAL: The primary goal of this element of the restoration plan is to enhance the site's recreational opportunities by creating a water trail for use by kayaks and canoes. The creation of the proposed waterways will extend and connect the site's existing areas of open water. The expansion of open water will establish extensive new areas of adjacent emergent wetlands along the lake edge and along the edge of connecting waterways. Over time, these actions will naturalize the waterways by improving hydrologic flow while providing additional wildlife habitat. These features will also improve the passage of aquatic organisms between wetlands and ponds, expand navigability for kayakers, and provide a physical barrier to ATVs through a moat-like system that will impede vehicular trespass and help to defend and protect sensitive habitat.

ACTION: The expansion of the site's open water will require creation through the excavation of a series of major new waterways, as well as the deepening of existing waterways that lack sufficient depth for year-round boating. The creation of connecting waterways is intended to integrate existing open water and emergent wetland areas with newly-created open water and wetland areas.

STEWARD: Management of this new resource will be limited. Once the connecting waterways are constructed, operation, and maintenance will remain the responsibility of Ocean County. The primary maintenance requirement will be to keep the waterways open for unimpeded kayak and canoe access. Over time, channels may need to be dredged and may also require periodic removal of aquatic vegetation by mechanical cutting or herbicide use.

An aerial view of the finger lagoons

Fill along the edge of the lake

FIGURE 14: *By establishing a network of interconnected open waters through the extension and connection of existing fingers of the lake to other fingers and small ponds, there will be improved aquatic organism passage between wetlands and ponds as well as a connected water trail for kayaking and canoeing.*

3. EMERGENT WETLANDS

FEATURE: Broad swaths of emergent wetlands totaling 57.65 acres are proposed along the shorelines of the lake, its fingers, and connecting waterways. The emergent wetland community is envisioned to be dominated by a mix of herbaceous perennial vegetation indigenous to the pinelands. The new wetland habitat will include the establishment of a safety bench system which will limit access to the deeper lake waters. This will be achieved by reshaping the lake edge through excavation and filling to create a minimum 20- to 30-foot-wide bench with a very shallow slope (10:1) along most of the lake edge. In other areas, this feature will be considerably larger, especially where located between existing features. It is in these broader areas of emergent wetland where there is an opportunity to enhance amphibian habitat through the creation of shallow ponds.

The creation of emergent wetland habitat along the edge of a lake will provide important habitat for aquatic organisms, amphibians, waterfowl, and wading birds. This habitat type is targeted for areas containing a continuum of shallow water no more than three feet deep and extends to the shoreline of the lakes and connecting waterways. The establishment of emergent wetland vegetation in the emergent wetland will be critical to stabilization of the benches, to the lake shoreline and to connecting waterways. Once established, these areas will provide prime habitat for waterfowl, especially ducks, wading birds, fish, aquatic organisms, and represents a net increase in the acreage devoted to this habitat type. These areas will be important for wildlife viewing, shoreline revegetation, aesthetics and experience of kayakers, canoeists, cyclist, and hikers.

GOAL: The creation of emergent wetlands along the existing lake, its fingers, and connecting waterways will require extensive regrading to create the desired elevations. Emergent wetland areas will be created by installation of benches adjacent to open water features, set below the lake's normal water elevation so that they are shallowly inundated by no more than three feet of water. The plant community envisioned will consist of a variety of herbaceous vegetation such as rushes, sedges, and floating plants such as little floating heart (*Nymphodes cordata*) and water lily (*Nymphaea odorata*). Emergent wetland communities such as proposed typically consist of distinct zones based on depth. For example, the deeper portion of these planting areas will consist of species such as water lily and spatterdock (*Nuphar luteum*), while the shallower areas near the shoreline will include three square (*Schoenoplectus pungens*), slender bur-reed (*Sparganium americanum*), Canada rush (*Juncus canadensis*), and wool grass (*Scirpus cyperinus*).

ACTION: Plant material should be indigenous to the pinelands and adapted to the low nutrient environment of the site. The establishment of plants in the emergent wetland can be achieved through a combination of planting and natural colonization. Proposed plants for installation include water lily, spatterdock, pickerel weed (*Pontederia cordata*), slender bur-reed, three square, wool grass and Canada rush. Based on the naturalized edges of existing ponded areas on the site natural colonization of these areas is expected to include cranberry (*Vaccinium macrocarpon*), little floating heart, pipewort (*Eriocaulon aquaticum*), yellow eyed grass (*Xyris sp.*), and spatulate leaved sundew (*Drosera intermedia*). As many of the plants found in this type of community in the pinelands are not typically propagated by nurseries consideration should be given to the propagation of uncommon plants or their transplantation from other parts of the site that may be disturbed during restoration activities. Rapid establishment of vegetation in the emergent wetlands is anticipated with an increase in density and diversity over time. As an action outcome these areas will be particularly important as a fishery nursery, where recruits or young-of-year will shelter amongst the vegetation. The integration of habitat features such as the use of woody material (tree stumps and logs) will enhance habitat complexity and replication of natural features.

STEWARD: Future management requirements are anticipated to be limited but may include supplemental planting of less common pinelands plants and invasive species management of undesirable species such as purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) that may colonize the site. On a positive note, due to the naturally low pH and nutrients of the site the presence of invasive species tends to be very minor, especially for a highly disturbed landscape.

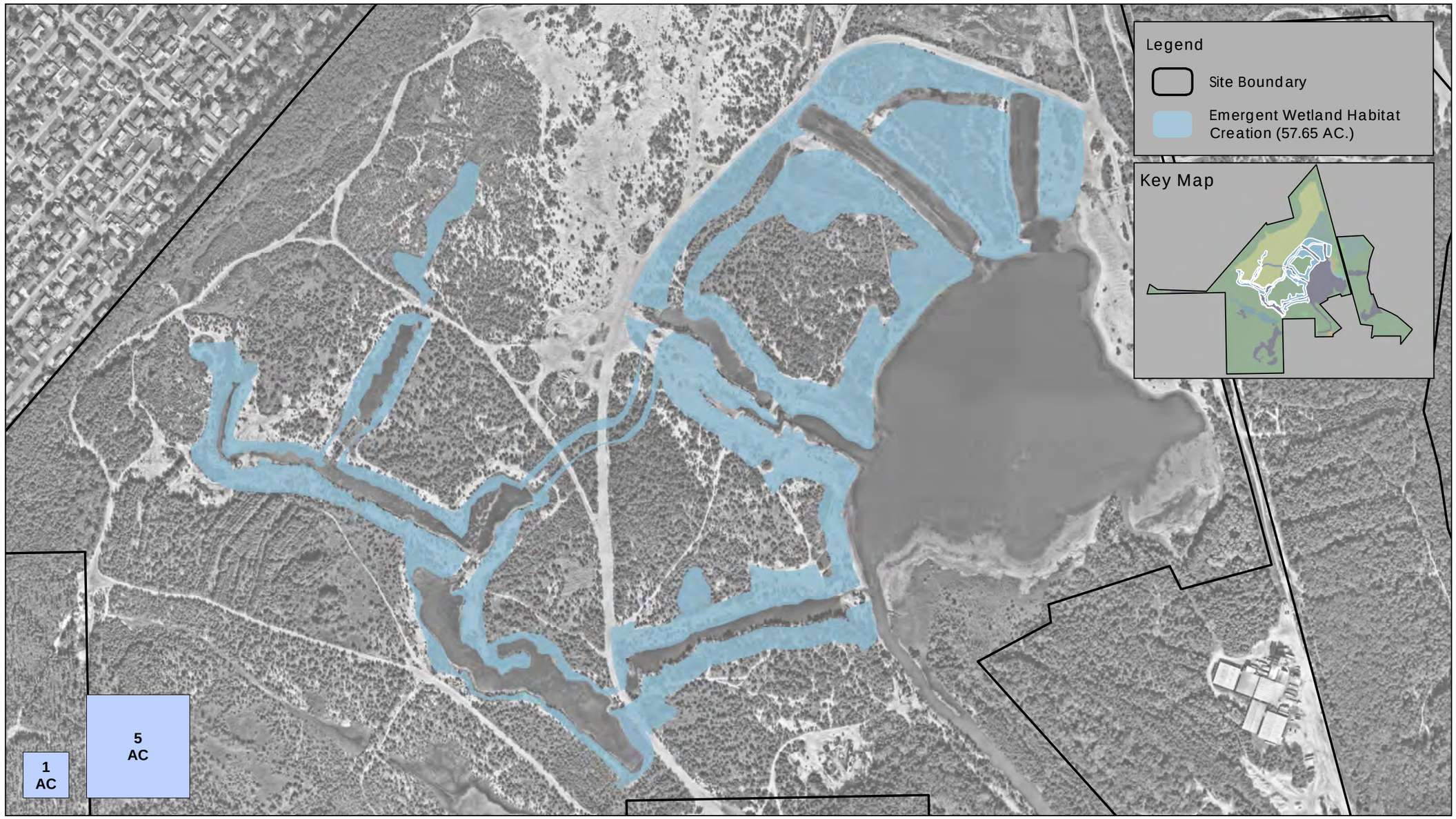


FIGURE 15: *The emergent wetland habitat creation area is designed to naturalize the edge of the lake and provide habitat for fish, amphibians, waterfowl, and wading birds.*

4. BOG

FEATURE: This creation opportunity focuses on expanding an existing wetland to create approximately 10.57 acres of bog. The bog will exhibit seasonally-variable depth and be fed, in part, by the remnants of a small tributary to Mill Creek. The plan is to enlarge the lower portion of the bog by naturalizing adjacent steep slopes. This will require slope regrading for a more natural transition to the adjacent successional pine forest. The upper part of the bog will require stabilization of its upper reaches where it receives runoff from off site. This will require excavation and development of isolated low cells or step pools in three narrow portions of the channel. Each cell would be designed to retain water to create a shallow pool of native plant species. Existing wetlands proximate to the bog will serve as a reference guide to plant selection and seed sourcing.

GOAL: The objective is to naturalize the area bordering the existing wetland and to stabilize the channel to the wetland. The softening of steep slopes will facilitate access to the wetland by park visitors and showcase the area for education. The existing wetland has recovered well since mining abandonment almost twenty years ago. The wetland possesses a species-rich flora with greater diversity than more recently abandoned mine areas. Common species included water lily, lesser bur-reed (*Sparganium americanum*), little floating heart, threesquare, cranberry, spatulate leaved sundew (*Drosera intermedia*), meadow beauty (*Rhexia spp.*), and yellow eyed grass (*Xyris spp.*). Due to the hydrology, this emergent wetland should develop over time into a complex bog community characterized by the accumulation of organic matter. The endpoint of the natural development is a bog dominated by sphagnum mosses and by heath shrubs. Transition to a mature bog community requires 15 to 20 years. Importantly, characteristic bog species such as sphagnum moss are already present in this wetland system.

ACTION: In the upper portion, three wetland cells will be created through shallow excavation of 18 to 24-inches. Excavated material will be used to create a low berm to impound water with excess discharge over a log vane or similar structure. The disturbed area of the pool will be planted with pinelands species. Enlarged portions of the bog will include an area of wetland as well as the modified slope. The wetland area will likewise be planted with analog pinelands species. The area will include addition of stumps and nurse logs to replicate deadfall and provide greater habitat complexity. Once the woody material begins to decay, microsites for seedling establishment are expected. This provides the basis for development of hummock hollow microtopography. The area can be revegetated via seeding, plugs and seedlings. Species to be used for this planting include slender bur-reed, Canada rush, wool grass, and three square. The installation of leatherleaf (*Chamaedaphne calyculata*) is also recommended along the edges of the wetland to establish an on-site population.

STEWARD: Development of a bog at this location will take many years so the stewardship objective is reasonably passive and patient. Effort should be focused on fostering expansion and development of wetland and regrading steep slopes. Long-term management should be limited although adding desirable (non-nursery) species is encouraged. Management of invasive species is also recommended.

Area of Future Bog Habitat

Water Lily

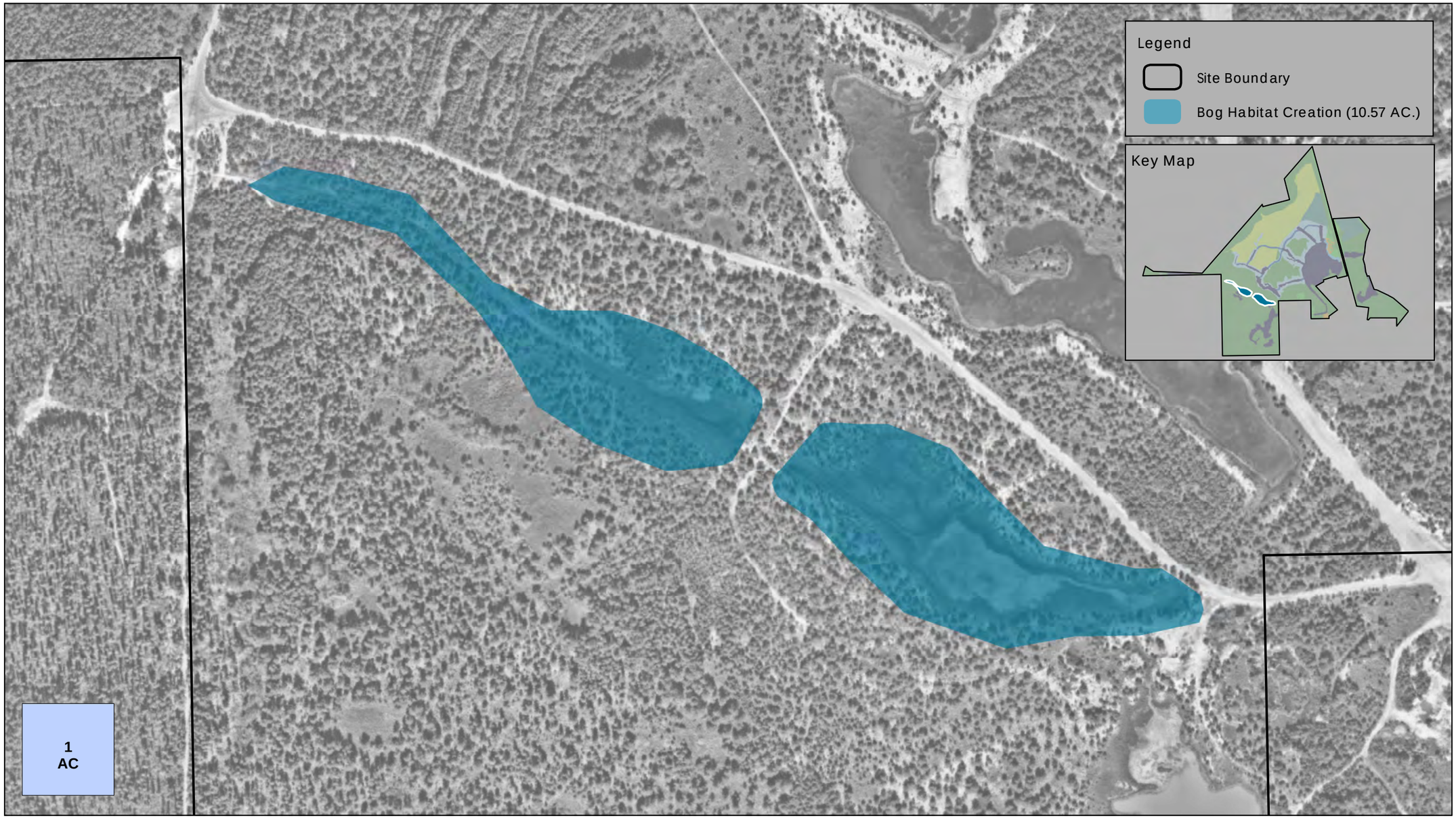


FIGURE 16: *For the creation of bog habitat, edges of the existing wetland will be naturalized and erosion prone areas will be stabilized to facilitate access to this area for wildlife watching and educational purposes.*

FIGURE 17: *Conceptual Plan for the Bog Habitat Creation Area*

5. EPHEMERAL WETLANDS

FEATURE: The site includes several areas that possess ephemeral wetlands, one north of the lake and west of Barnegat Branch Trail, and the second east of Trail (and north as well). Ephemeral wetlands are closed-depressional features that temporarily retain water, generally following storm events during the first half of the year, or as the result of seasonal high water. Although this creation area focuses on ephemeral wetlands, the matrix of this habitat type is currently envisioned to stay as a mix of both upland grasslands and wetland grasslands or savanna. By late spring or early summer these wetlands normally dry up, hence the term 'ephemeral'. Seasonally-flooded areas provide valuable habitat to waterfowl and wading birds like glossy ibis (*Plegadis falcinellus*), herons and egrets (*Ardeidae*), as well as shorebirds and amphibians including spadefoot (*Scaphiopus holbrookii*) and Fowler's toad (*Anaxyrus fowleri*). The ephemeral wetlands are the result of mining and are damaged by constant ATV trespass and require intervention and management if they are to stabilize and prosper as wetland habitat.

GOAL: The plan calls for a restorative design that enhances intermittent surface hydrology of existing ephemeral wetlands through deepening and redirection of surface runoff, and the modification of drainage outflows to capture and retain precipitation and runoff. This requires substantial regrading to minimize extensive flooding that occurs during large rainfall events by increasing positive drainage toward the ephemeral wetland areas and downslope to the main lake. It is envisioned that the ephemeral wetlands will be located within a matrix of upland and wetland (savanna) grassland communities. Deeper pools within the ephemeral wetlands are contemplated to provide amphibian habitat. The ephemeral wetlands and accompanying wildlife will be visible from the Barnegat Branch Trail, and from connecting trails routed along higher perimeter landscape positions.

ACTION: Both areas require grading and reestablishment of vegetation. The grading proposed to the east of the Barnegat Branch Trail is limited to minor grading needed for elimination of existing ATV ruts and compaction, and to prepare the soils for seeding and addition of woody material. Deep excavation is to be limited to scattered areas of deeper pools designed for amphibian habitat. The area to the west of the Trail will require more extensive grading to create positive drainage (toward the lake), remove off-road trails, and widen and deepen the existing depression. Inclusion of salvaged woody material will be placed within and along the deeper pools to provide loafing habitat for birds and amphibians.

The areas surrounding the ephemeral wetlands should be planted with the same seed mix proposed for grassland habitat. The establishment of vegetation in the ephemeral wetlands is more complicated as the desired vegetation is unavailable from seed suppliers and nurseries. As such, the approach is to establish temporary cover through seeding supplemented with installation of desirable nursery grown material. This would allow for natural colonization. Supplemental contract-grown plant material or transplanted material would also be desirable. Initial seeding mix should comprise Fall panicum (*Panicum dichotomiflorum*), three way sedge (*Dulichium arundinaceum*) and switchgrass. The fall panicum is an annual grass that will provide initial stabilization and over time be replaced by more desirable pinelands species. The installation of several species of nursery grown plant material such as Canada rush (*Juncus canadensis*) and wool grass is also recommended. The placement of culverts under the proposed secondary trail off of the Barnegat Branch Trail will be set at an elevation to facilitate the retention of water by the ephemeral wetland while permitting downslope flow during larger storm events. It is also important to configure the culvert to prevent the passage of fish into these wetlands to limit predation on the amphibians and egg masses expected to utilize this type of wetland.

STEWARD: A functional, stable ephemeral wetland should be established within two years of construction. Management should include invasive species control and supplemental plantings, as necessary. As noted, many species commonly found in ephemeral wetlands may have to be contract-grown or transplanted from other parts of the Pulverizing site.

FIGURE 18: *The Ephemeral Wetland Habitat Creation area is envisioned to be a complex of habitat types focused on ephemeral wetland habitat enhancement and the creation of deeper pools for amphibian habitat.*

6. GRASSLAND

FEATURE: Nearly 100-acres of grassland will be created in the northwestern quadrant of the site, extending eastward from the foot of the 30- to 45-foot high bluffs abutting Beachwood Borough. Grassland is a diminished habitat type within New Jersey and is rarely found within the pinelands and Shore region. Creation of an extensive grassland on the Pulverizing site will provide vital habitat for nesting birds including grasshopper sparrow (*Ammodramus savannarum*), Savannah sparrow (*Passerculus sandwichensis*), field sparrow (*Spizella pusilla*) and American kestrel (*Falco sparverius*). Recently created grassland at the Lakehurst Naval Air Station provides habitat for the state's largest known breeding population of upland sandpipers (*Bartramia longicauda*). Given site topography and the short height of selected grassland species, trail users will enjoy unobstructed views to neighboring habitat areas; wetlands, water and forest. The grassland will be bordered to the east by the principal arterial trail – the Barnegat Branch spur – and by a set of secondary foot trails.

GOAL: Creation of a large, contiguous grassland at the Pulverizing site represents a unique action. Not only is this habitat type rare and could attract several listed bird species but will convert a poorly-developed and semi-barren existing field consisting of monospecific patches of pine and switchgrass into vital habitat. The design objective unites the need for grassland habitat with the purposeful action of decompacting, restoring, and protecting a severely disturbed and species-poor area within the site. Selected grassland species will be adapted to this dry and sterile area, and will be indigenous to the pinelands region.

ACTION: Grassland creation involves a relatively straightforward program involving the removal of all or portions of the existing vegetation, reshaping the existing flatland to a gently undulating or pitched plain, removing old mining roads, and decompacting ATV trails and barren zones. A master grading and planting plan will be developed, and the area will be subsequently seeded with a mix of warm season grasses such as little bluestem (*Schizachyrium scoparius*), switchgrass, and broomsedge (*Andropogon virginicus*). The inclusion of small amounts of forbs such as butterfly weed (*Asclepias tuberosa*), common milkweed (*Asclepias syriaca*), horsemint (*Monarda punctata*), gray goldenrod (*Solidago nemoralis*) and narrow leaved sunflower (*Helianthus angustifolius*) will serve to attract pollinators. A functional, stable grassland should be established within two years of seeding.

STEWARD: Grasslands within the pinelands region are successional communities. As such they require periodic maintenance, principally annual mowing and/or fire management to arrest the process of ecological succession. The stewardship goal is to limit colonization by woody plants and invasive species. Supplemental plantings may be required, depending on spot success. Maintenance mowing should be undertaken in late winter to limit nesting impacts and improve winter wildlife habitat. Fire management via controlled burns will enhance nutrient cycling, establishment of pinelands species, germination of fire-activated seed and the reduction of accumulated fuel load. Inclusion of other habitat features such as nest boxes for tree swallow (*Tachycineta bicolor*), bluebird (*Sialia sialis*), and American kestrel (*Falco sparverius*) warrant consideration.

Butterfly Weed

An example of a native meadow.

FIGURE 19: *The Grassland Habitat Creation area is envisioned to be dominated by native warm season grasses and pollinator species.*

7. MILL CREEK STREAM CONNECTION TO MAIN LAKE

FEATURE: Currently, the lake at the Pulverizing Site is connected to Mill Creek by several hundred linear feet of culvert pipe, which impedes passage of aquatic species. This plan calls for a major infrastructure modification under the rubric of habitat creation. This will require two key components: a control structure that will determine the water level of the lake and a culvert or span to allow Mill Creek to flow under the Barnegat Branch Trail. The action requires replacement of the existing 18-inch wide iron pipe – that runs 100-feet beneath the Barnegat Branch Trail embankment – with a wide, open bottom culvert. This will create a naturalized stream bed and adjacent riparian habitat. The feature, labeled as 'naturalized infrastructure' will provide a stream channel function as it existed prior to construction of the Barnegat Branch Railroad. The open span should be at least three times as wide as the required wetted channel to mimic floodplain benches and promote the passage of aquatic and terrestrial organisms.

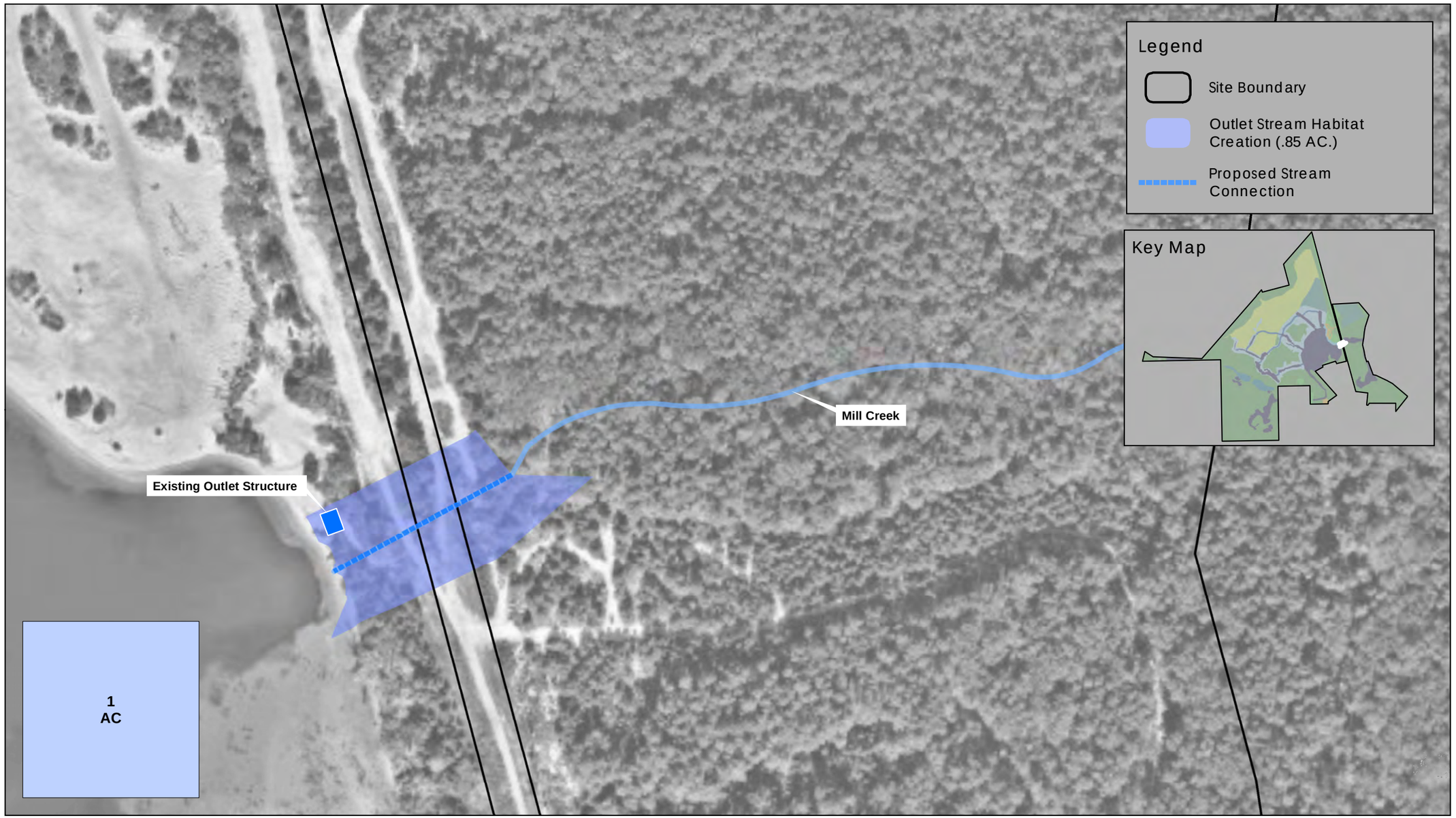
GOAL: The objective is to reconnect the open waters of the site to Mill Creek and the Barnegat Bay Watershed. The plan calls for a restorative design for a naturalized stream channel to promote Aquatic Organism Passage (AOP). The current outlet structure serves as a barrier to aquatic movement. Successful AOP allows the site to be colonized by an assemblage of pinelands organisms present in Mill Creek. The estuary reconnection will greatly improve on-site aquatic systems and terrestrial habitat. It will help establish a run of diadromous migratory fishes including shad and herring (*Alosa* spp.). The existing culvert is problematic on a number of levels. First, the existing system is poorly designed, and the drainage intake grate and riser installed at the main lake is frequently obstructed with debris, which results in flooding and chaotic water level fluctuations within the lake. In addition, the intake can be dangerous and prone to trapping animals in its flood vortex; the system was designed for mining and not for lake management. Improved infrastructure design will reduce maintenance, manage flood staging, increase public safety and habitat value.

ACTION: The proposed open bottom design includes a daylit stream channel flanked by small floodplain benches (See, Figures 20, 21, 22). Construction will entail the removal of the existing outlet and culvert system, creation of a naturalized channel and floodplain, installation of a grade control device to set lake stage and prevent headcutting through use of a rock vane or similar naturalized structure and construction of an architecturally unique rail style open culvert beneath the main corridor of the Barnegat Branch Trail. The floodplain will be planted in accordance with the riparian zone planting plan (See, **Appendix "H"**). The plan for this channel promotes passage of terrestrial organisms and ensures adequate channel dimensions for storm events. It should replace the existing outlet and berm system as a regulated dam as the structure exceeds ten feet in height (from the outlet invert to the top of the rail corridor) per regulatory parameters. Existing utilities, including power and gas that run with the trail corridor, will be addressed during the project's permitting phase. The control structure will be designed to blend into the site's landscape. The new channel is likely to be as small as the average annual lake discharge, or roughly three cubic feet-per-second.

STEWARD: Designed correctly, this should be a low- or no-maintenance improvement. Adaptive management should address potential channel instability but given the low stream energy, erosion potential remains low. Planting should be monitored, and the culvert will require regular inspection. The floodplain should be planted with native shrubs and small trees (see, **Appendix "H"**). Invasive species control and supplemental plantings may be required.

Culvert between the ponds

Wet areas adjacent to the main lake



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NOTES:
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2.Site boundary obtained from Ocean County Department of Planning.
3. 09/28/2019 aerial obtained from Nearmap.

OUTLET STREAM HABITAT CREATION

0 50 100 Feet

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BERKELEY TOWNSHIP
OCEAN COUNTY, NEW JERSEY

FIGURE 20: *This plan seeks to reconnect the lake to Mill Creek through the implementation of a restorative design for a naturalized stream channel to promote aquatic organism passage.*

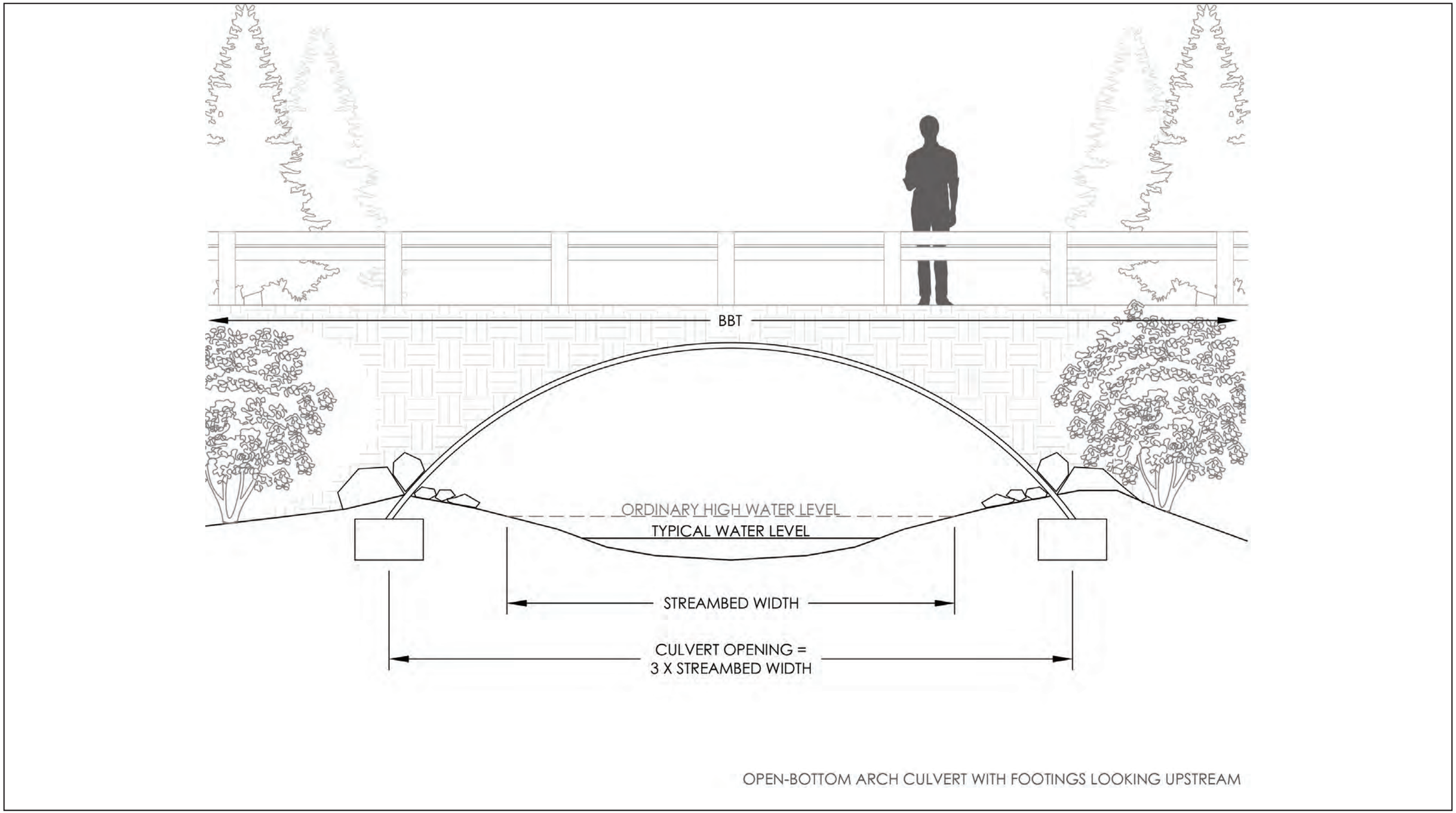


FIGURE 21: *Open Bottom Culvert Cross-section*

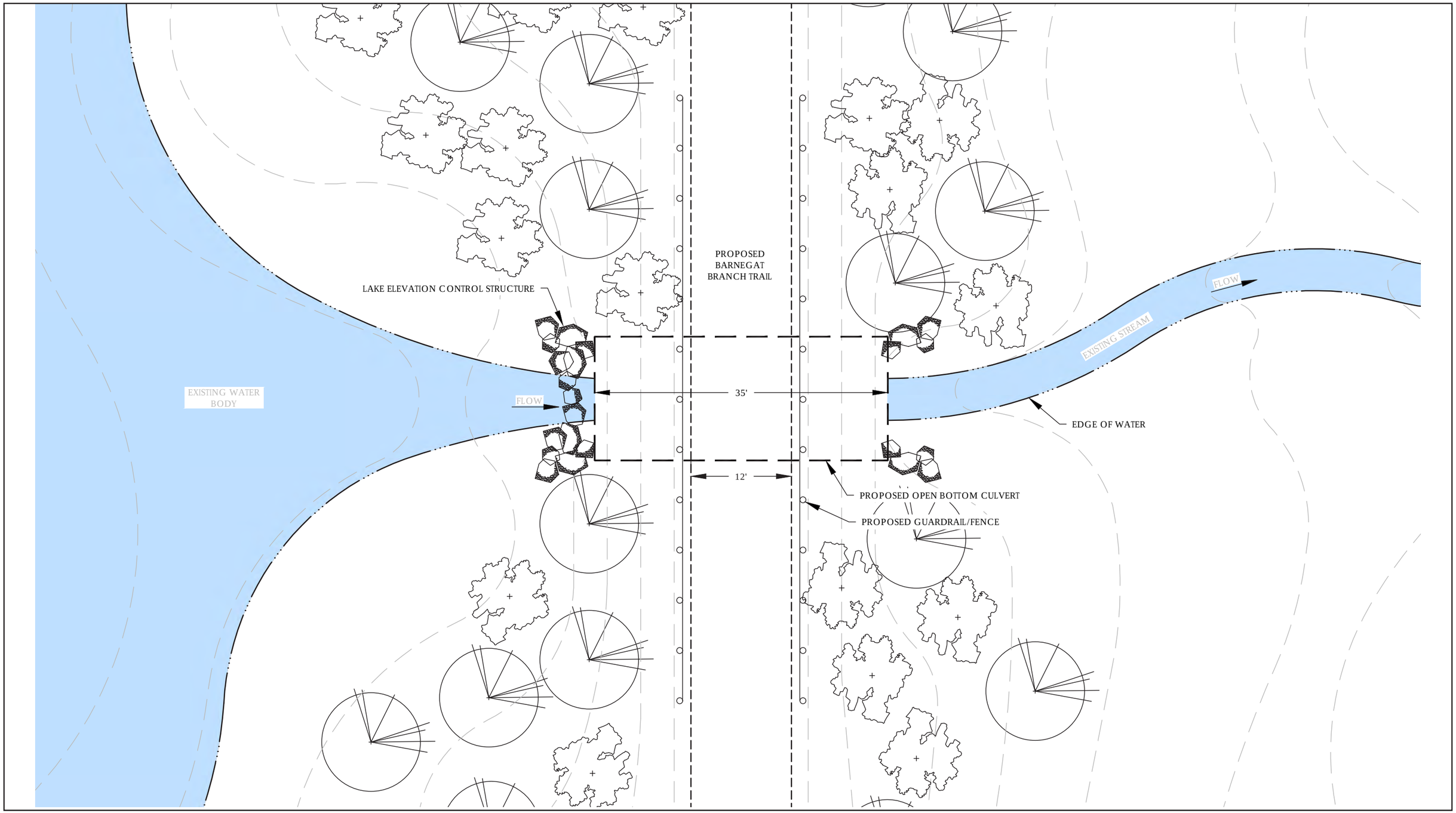


FIGURE 22: *Open Bottom Culvert Plan*

8. SUCCESSIONAL WOODLANDS

FEATURE: Create successional woodlands in selected barren areas throughout the site. This includes regraded or steep slopes along the Barnegat Branch Trail embankment (vicinity of main lake), interior mining service roads, ATV trails and selected compacted areas. Successional woodlands in this context shall contain a mix of common woody plant species planted in a matrix of grassland species. This planting type is designed for use areas that warrant rapid establishment of vegetation.

GOAL: Successional woodlands are used for infill habitat creation where needed and as needed on the Pulverizing site. As noted, the establishment of successional woodlands is proposed in areas that are currently barren as well as areas such as steep slopes that will be subject to regrading during site restoration. The area west of the Barnegat Branch Trail (proximate to the lake) warrants regrading and removal of several tons of buried mining and access control debris, a parallel ATV track, and other barren areas located within the planned Lakeside Public Access Area. Successional woodlands, including woody and herbaceous species, are proposed for selected disturbed areas owing to rapid vegetative establishment, particularly where soil stabilization is required.

ACTION: The installation of successional woodlands should commence after completion of regrading work. Planting in areas of existing roads requires that the soils in the roadway are decompacted to foster the successful vegetative establishment. Plant material includes a mix of small tree, shrub, and herbaceous species, including a variety of early successional fast-growing trees such as Eastern red cedar (*Juniperus virginiana*), pitch pine, winged sumac (*Rhus copallina*), bayberry, and black cherry (*Prunus serotina*) to be naturally replaced over time by pitch pine and other dominant community species. The grassland seed mix component of this planting type will be the same as that previously described for the grassland previously (page 57). The composition of the species in this planting type can be modified based on the existing environmental conditions of specific locations previously outlined but can also vary according to the intended use at a specific location. For example, reliance solely on the grassland seed mix component of this planting type can be used in areas along the Barnegat Branch Trail to establish unobstructed views of the lake.

STEWARD: These areas may require significant management during the early years of establishment and will require regular inspection. Since this planting type is targeted for disturbed areas that presently lack vegetative cover, reestablishment may be difficult. Regrading, slope softening and planting address management challenges. Replanting may be necessary but once the area is stabilized, natural succession and full revegetation is expected. Lastly, successional woodland will be created in selected areas that possess undesirable or invasive plants, including the Barnegat Branch Trail corridor, where invasive species management will be necessary by herbicide or mechanical means. In areas that relied on the establishment of grasses for stabilization, periodic maintenance (i.e. mowing) will be needed in order to maintain the community composition and structure.

Steep Slope along the Barnegat Branch Trail

Western slope

FIGURE 23: *Successional Woodland Creation areas are envisioned to provide variable planting options based on the specific habitat goals for each area. In areas overlooking the lake, lower growing native vegetation would be selected, while in other areas, such as on stabilized steep slopes, tree species would be included.*

C. HABITAT PRESERVATION

A. PUBLIC ACCESS

B. HABITAT CREATION

C. HABITAT PRESERVATION

1. Successional Pine Forest
2. Mature Forest
3. Wetlands and Open Waters

INTRODUCTION TO HABITAT PRESERVATION

Habitat Preservation areas are not considered for substantial modification as these areas contain established high-quality plant communities and site-adapted species and seedstock. These areas are integral to long-term plan success as they provide ecological connections and important aesthetic value to proposed creation areas. Preservation areas are stable and will provide a source of propagules and animals that will recolonize created habitat at appropriate stages during maturation. Preservation areas require periodic management but at a less-intensive scale than creation areas. The design objective for preservation areas speaks to sustaining and guiding – rather than altering – the current ecological state.

This section contains three preservation projects: successional pine forest, mature forest, and wetlands and open waters.

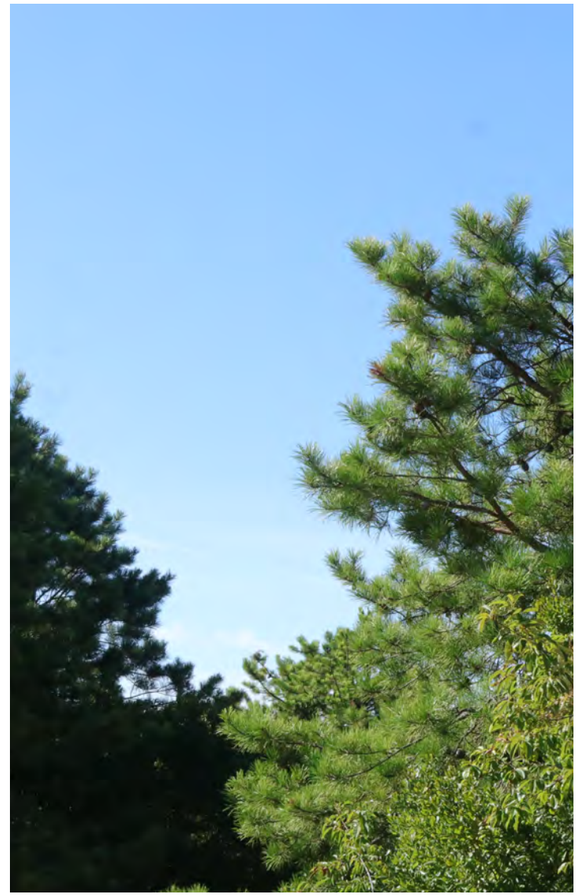
1. SUCCESSIONAL PINE FOREST

FEATURE: Successional pine forest covers 264.48 acres of the site, primarily in the southern and western area. This plant community is characterized by the dominance of pitch pine bearing a range of age classes based upon the disturbance history of mined, abandoned areas. Most areas were abandoned approximately 18 years ago and some areas even longer. Several areas abandoned prior to 2002 were also planted to facilitate the establishment of forest cover. Successional forests identified for preservation are those presenting the best examples of this community type and least affected by ongoing disturbance, and, left alone would continue to develop to mature communities typical of the pinelands. These communities are species rich, fit with pinelands ecology and are native and adapted to the Pulverizing site. In addition, and due to mining abandonment, local conditions and wildfires, the existing forest contains stands of varied age and canopy cover. If left alone these forests will develop into a mature, climax community. Successional forests benefit the site by helping stabilize and enrich soils, improve water retention and infiltration, and support pinelands amphibians, reptiles, insects, birds, and mammals.

GOAL: Preservation is aimed at maintaining existing stands of these younger successional pine forests with incomplete canopy coverage, establishing a successional development trajectory, which will benefit from prescribed burns that will favor pines and eliminate fire intolerant species.

ACTION: As a preservation area, no immediate area-wide action is required. Roadway reclamation is proposed for areas not incorporated by the trail network, and, as previously noted, will involve decompaction of soils and planting of vegetation. Selected roadways can be managed as fire breaks.

STEWARD: Long-term management requires prescribed burns to promote fire ecology of the community and to protect neighboring forests and real property from large, uncontrolled events. Benefits of controlled burns include fuel load management, understory management, nutrient cycling, seed germination, reduction of oak density and limiting canopy closure (to improve stand health) and management of invasive species. Selected areas should be developed for wildlife enhancement through construction of habitat enhancement measures such as artificial hibernaculum for reptiles.



Pine Forest

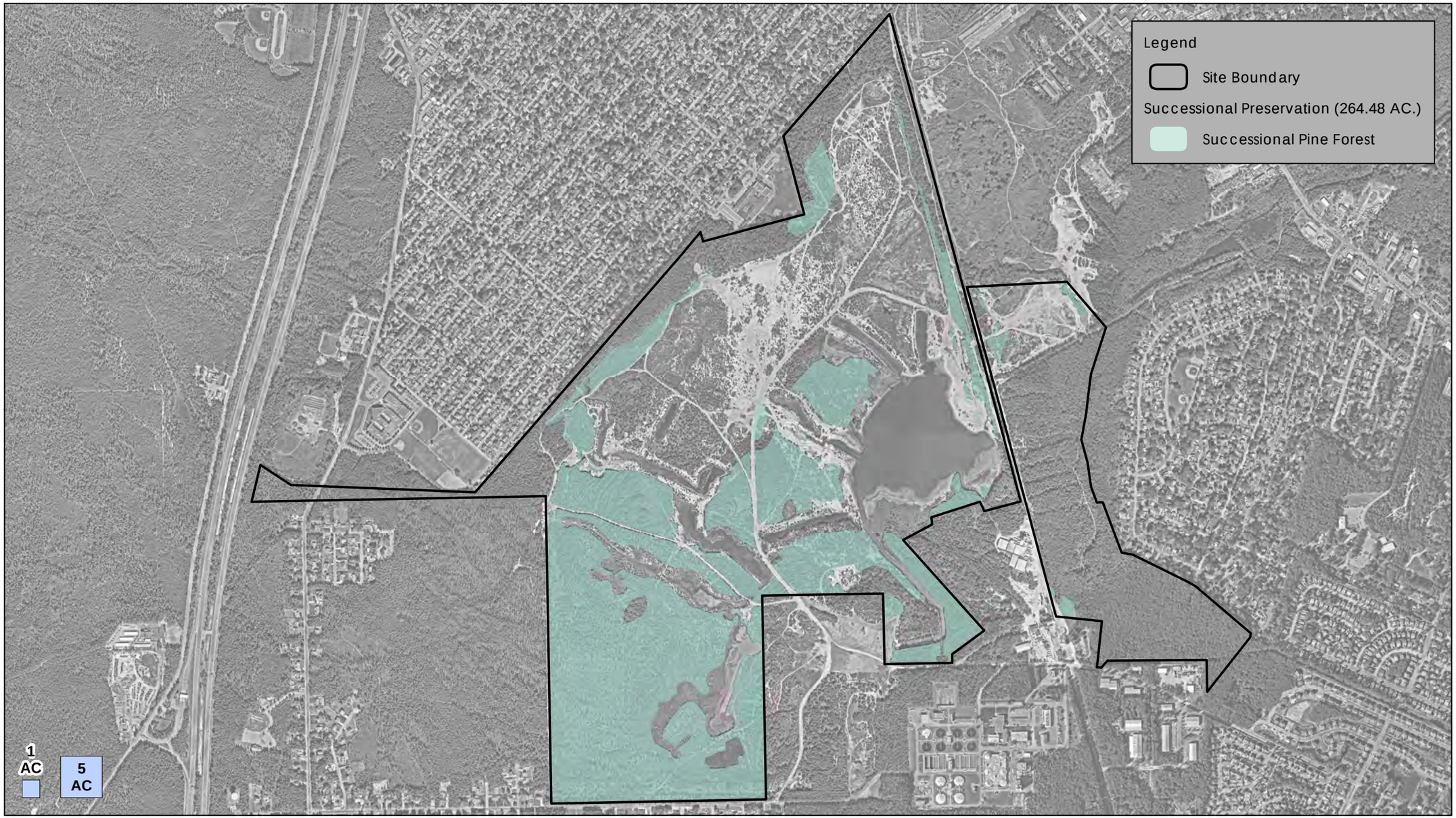


FIGURE 24: *Successional Pine Forest Preservation*

2. MATURE FOREST

FEATURE: The Pulverizing site also supports several mature forest communities including mature mixed oak-pine forest, mature oak forest, and mature pine forest. These communities are located at higher elevations across the site's northwestern area, western spur, slopes appurtenant to the Barnegat Bay Trail and south of the main lake. Together, the mature mixed oak-pine community covers roughly 18 percent of the total land area of the Pulverizing site. Mature forest habitat adds complexity by serving as a locally-adapted seed bank for different species and contains large trees, a well-developed shade canopy, wildlife benefits and aesthetic or landscape value to trail users.

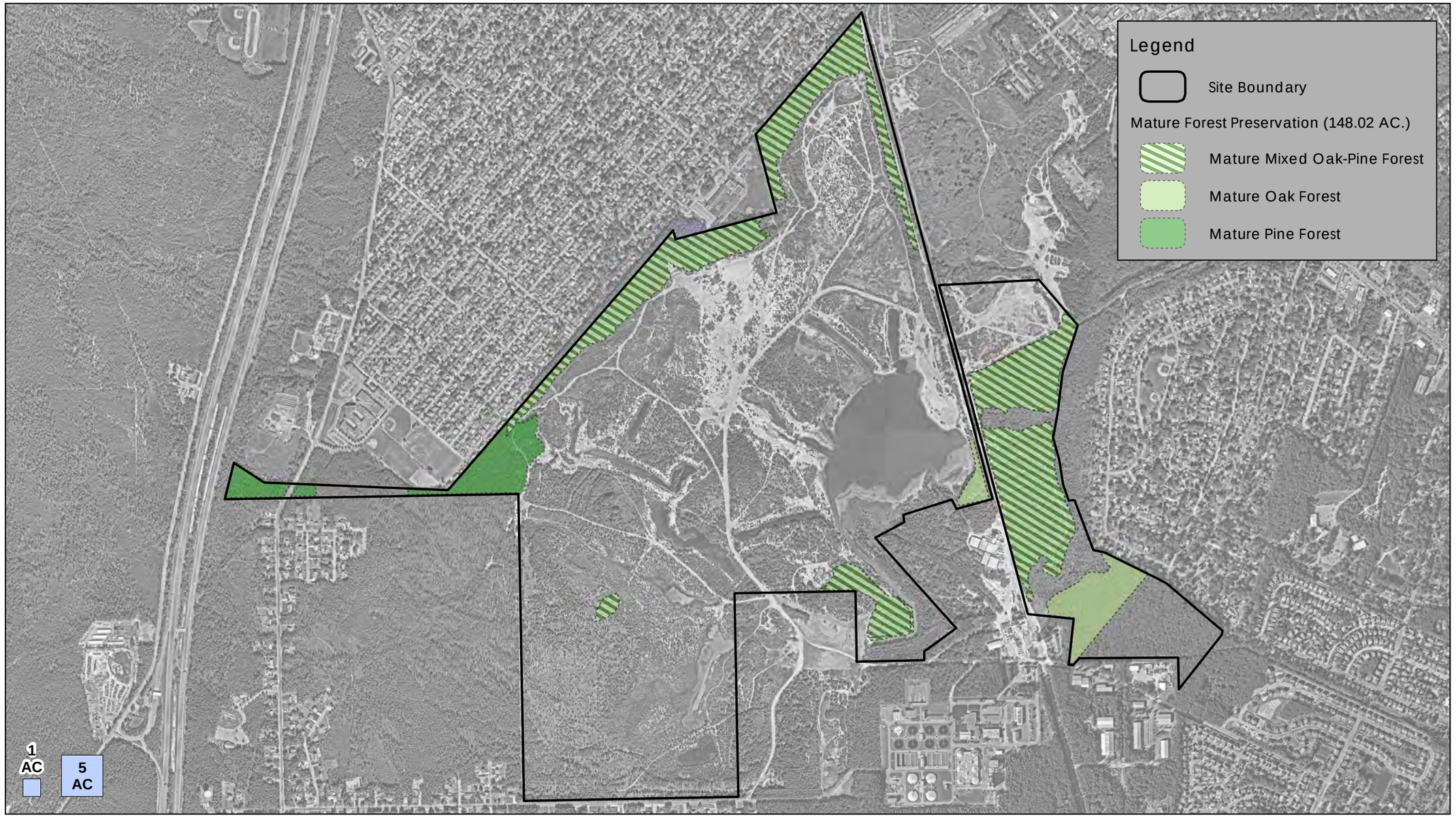
GOAL: These mature communities are associated with portions of the site that were not mined and are located within areas of higher elevation, steep slopes, and drier soil conditions. These communities date to pre-mining times and should not be confused with communities associated with successional pine forest and old field species which dominate abandoned mining areas. Mature forests serve as wildlife corridors since they are located primarily along the margins of the site and support niche species such as the cavity-nesting red-bellied woodpecker (*Melanerpes carolinus*) which otherwise lacks habitat in mined portions of the site. Mature forest communities serve as a seed source for establishment of localized pinelands species.

ACTION: No action required. As mature communities their primary value is one of preservation.

STEWARD: Management is expected to be minimal, although some fire management should be scheduled for abutting mixed oak-pine forest, especially along the northwestern boundary adjacent to residential and institutional areas in Beachwood Borough.

A view of the forest.

An aerial view of the Mature Forest



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MATURE FOREST PRESERVATION

0 500 1,000 Feet

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OCEAN COUNTY, NEW JERSEY

FIGURE 25: *Mature Forest Preservation*

3. WETLANDS AND OPEN WATERS

FEATURE: A variety of wetland communities within the site have been identified for preservation. These include open waters of the main lake, whose clarity, oligotrophic conditions, and depth must be respected. For different reasons, the same planning principles apply and the finger lagoons that radiate from the main lake whose dystrophic, tannic-stained waters and wetlands – including emergent marshes and early successional bogs – require protection. In addition, forested wetlands include pitch pine lowlands located at the site's western spur and hardwood swamps in the Mill Creek valley east of the Barnegat Branch Trail. The lowland pitch pine forest is representative of an undisturbed wetland community, while the hardwood swamp likely replaced an earlier Atlantic white cedar swamp lost to mining. All wetland communities proposed for preservation provide important ecological services and support pinelands flora and fauna. Open water and wetlands are relatively new habitat for the Pulverizing site and lend themselves to protection and expansion.

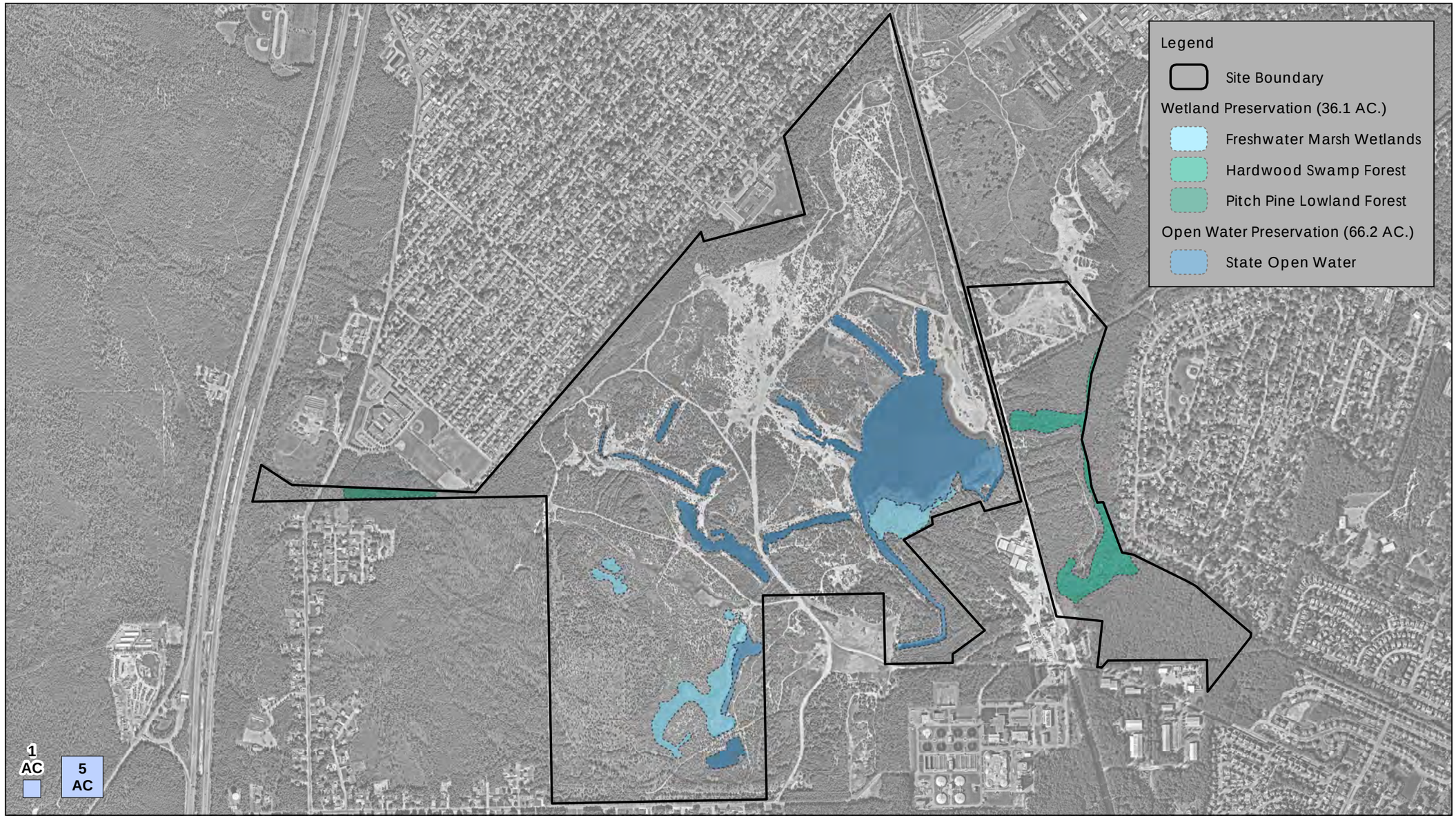
GOAL: The preservation objective for open water and wetland areas is to secure and properly manage as ecological assets and sustainable public access lands consistent with a Natural Lands Trust preserve. The main lake, in particular, is central to passive recreation; kayaking, hiking, angling, and birdwatching. It also plays a controlling role vis-à-vis site hydrology and ecology. From a public use perspective, the main lake serves as the centerpiece for visitors given human attraction to water, along with the sheer number of activities and habitat improvements outlined in this plan. Other open water areas intended for preservation include emergent wetlands, which will be used as ecological analogues for creation of new wetland areas.

ACTION: Activity within the Pulverizing site's preserved habitat areas is purposely limited. However, this does not preclude the extension of trails – terrestrial and water – along and/or through the areas so that they may be enjoyed, studied, and managed. For instance, the bog wetland located in the southwest quadrant will be widened to naturalize bordering slopes and the ephemeral channel that drains to the bog stabilized. These are deemed contributory preservation actions. So too with plans for systematically extending lagoons and connecting waterways passages from the main lake's radiating fingers, as the new channels will aid land preservation and management work.

STEWARD: Stewardship within preservation areas is focused on maintenance, with limited habitat enhancement measures such as invasive species control. The open water areas may require a greater level of maintenance and monitoring as the work plan is advanced to design, permit, phase, construct and welcome the public to the site. Long-term management of open water, especially development and guidance of the fishery, is critical. A stocking program is recommended to establish chain pickerel (*Esox niger*), brown bullhead (*Ameiurus nebulosus*), and yellow bullhead (*Ameiurus natalis*). Repeated stocking may be necessary. Establishing a monitoring program that incorporates water quality monitoring may be important for identification of future impairments to open water areas.

Established Pond

Main Lake



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WETLANDS AND OPEN WATER PRESERVATION

0 500 1,000 Feet

FORMER NJ PULVERIZING TRACT
BERKELEY TOWNSHIP
OCEAN COUNTY, NEW JERSEY

FIGURE 26: *Wetlands and Open Water Preservation*

FIRE MANAGEMENT

Wildfire is an important natural disturbance that influences the composition and succession of ecological communities within the site. In response to wildfires, species have adapted to the landscape. For example, pitch pine cones exhibit serotiny, an adaptation whereby seed release occurs in response to an environmental trigger such as heat generated by wildfires. In addition, pitch pine has an ability to resprout quickly from both the trunk and the roots after fires. Other characteristic pinelands species including fire-tolerant oaks and shrubs rapidly resprout from their root system after fire. Regular, fairly low intensity burns such as those typical of a controlled burn are beneficial as they limit the accumulation of organic litter and understory vegetation and reduce the intensity of the fire. Periodic burning of these forests also results in a more open canopy, often with open clearings and patches of bare soil. While pinelands communities are reliant on wildfire for their composition and structure, wildfires also pose a risk to human life and property. In collaboration with the New Jersey Forest Fire Service this wildfire management plan for the Pulverizing site suggest measures to mitigate risk to human life and property, and secondarily, to maintain the unique character of the wildfire-dependent habitats proposed for preservation and creation.

The creation of fire requires fuel, heat, and oxygen. Wildfires can be created by natural factors (lightning strikes) or anthropogenic factors (human activity, campfires, and cigarettes). Based on consultation with the New Jersey Forest Fire Service for the project, the primary method identified to reduce wildfire risk on-site is fuel load management. Fuel load management techniques control wildfires by reducing the available fuel loads so that when wildfires occur the potential size and intensity of the blaze is minimized.

To manage fuel load within ecological communities prescribed burns are recommended. Prescribed burns

are initiated by a warden in accordance with established protocols. The burns are controlled, low-intensity fires that mimic the natural cycle of wildfire and limit risk of large, dangerous wildfires. Extensive planning goes into creating a burn plan. This includes geography, timing, weather, and wind conditions. For the Pulverizing site the optimal period to conduct prescribed burns is October through March and the recommended prescribed burn schedule within the mature mixed oak-pine forest includes an initial low intensity event, followed by a 5-7 year cycle of prescribed burns to reduce the fuel load.

This plan recommends that fire management be considered for at least two wildfire-dependent communities proposed for habitat preservation areas: (a) mature mixed oak-pine forest (page 69); and (b) successional pine forest (page 67). Mature mixed oak-pine forest occurs at the northwestern corridor of the site paralleling Berkeley Avenue. This ecological community is dominated by mature pine and oak species with scrub oak dominating the understory. This forest area is subject to frequent human-induced fires which pose risk to adjacent Beachwood neighborhoods. Successional pine forest occurs throughout the southern portion of the site. This ecological community is dominated by pitch pine saplings 15 to 20-feet in height. Because this community produces large fuel loads in a short period the risk of large, intense wildfires is increased.

The successional pine forest experienced a major wildfire in 2014. Due to the six years of regrowth this area currently possesses a high fuel load. Thus, the recommended prescribed burn schedule is as follows: an initial prescribed event to occur within the next few years and a follow-up event within three years, followed by a five-year burn cycle. This schedule has the dual benefit of mitigating wildfire risk while improving habitat suitability for pine snakes. In the absence of wildfire, the development of the successional pine forest will experience changes in community structure and species composition, specifically, greater representation of oaks, increased canopy cover, increased shrub density, fewer clearings and colonization by fire intolerant species. Together these changes will not only affect the character of this pinelands community but will also negatively affect pine snake habitat.

In addition, to the proposed fire management of the site's preserved forest communities an annual prescribed burn is recommended for the proposed grassland community. This management would preclude the colonization of this successional habitat by woody species, keep fuel loads low, and would promote vigorous growth in the spring. Annual grassland burns will serve to maintain the character of this unique community and ecological values anticipated for this created habitat.

Overall, implementation of a prescribed burn regime, as described above, will assist in managing fuel loads to reduce the risk of catastrophic wildfires, and support the maintenance of the unique characteristics of pineland forest communities as well as the proposed grassland community.

Yellow-bellied Sapsucker (Sphyrapicus varius)

SECTION FIVE

PLAN IMPLEMENTATION

PROJECT PHASING

Plan implementation comprehends two or three development phases (See, Figure 27: Phasing Plan). Work required for Phase 1-A and Phase 1-B is located west of the Barnegat Branch Trail, which should incorporate its construction as a separate project (i.e., utilizing funds other than non-Natural Lands Trust funds). Work required for Phase 2 is located entirely east of the Barnegat Branch Trail.

PHASE 1-A: Work for Phase 1-A is required prior to opening the site to the public and represents the most significant investment of funds, material, and labor. This includes: construction of the parking and embarkation area at Segal Avenue; excavation and stabilization of connecting waterways; development of the lakeshore public access area; creation of emergent and ephemeral wetlands; construction of the outlet stream connecting the main lake with Mill Creek; regrading of the northern area needed to establish positive hydrology and flow to the main lake; and lastly, construction and stabilization of the multi-use trail that encircles the lake and habitat areas immediately west. This 2.6-mile trail forms all-important connections with the Barnegat Branch Trail, the Segal Avenue parking and embarkation area and two existing sections of Barnegat Branch Trail located at the site's south and north ends. Trail work includes construction of four bridges required to carry the facility over connecting waterways, and a 0.3-mile connecting trail along both sides of Segal Avenue.

PHASE 1-B: Work for Phase 1-B is recommended but is not essential prior to opening the site to the public. Work for Phase 1-B includes final grassland grading and planting, establishment of the foot path through the grassland, bog and remainder pedestrian-only trails within the forest and bog areas southwest of the lake. Phase 1-B requires stabilization of eroded slopes and forest habitat areas along the site's Beachwood perimeter, and should include construction of trailhead parking and vehicular control within County-owned land south of the Beachwood Elementary School.

PHASE 2: Work for Phase 2 can be undertaken without interrupting public access or habitat areas completed during Phase 1. Phase 2 work includes grading and ATV controls needed for reestablishment of ephemeral wetlands located in the northeast quadrant, a future parking area with direct access to Route 9, and stabilization of pedestrian only trails within the forested wetland area east of the Barnegat Branch Trail.

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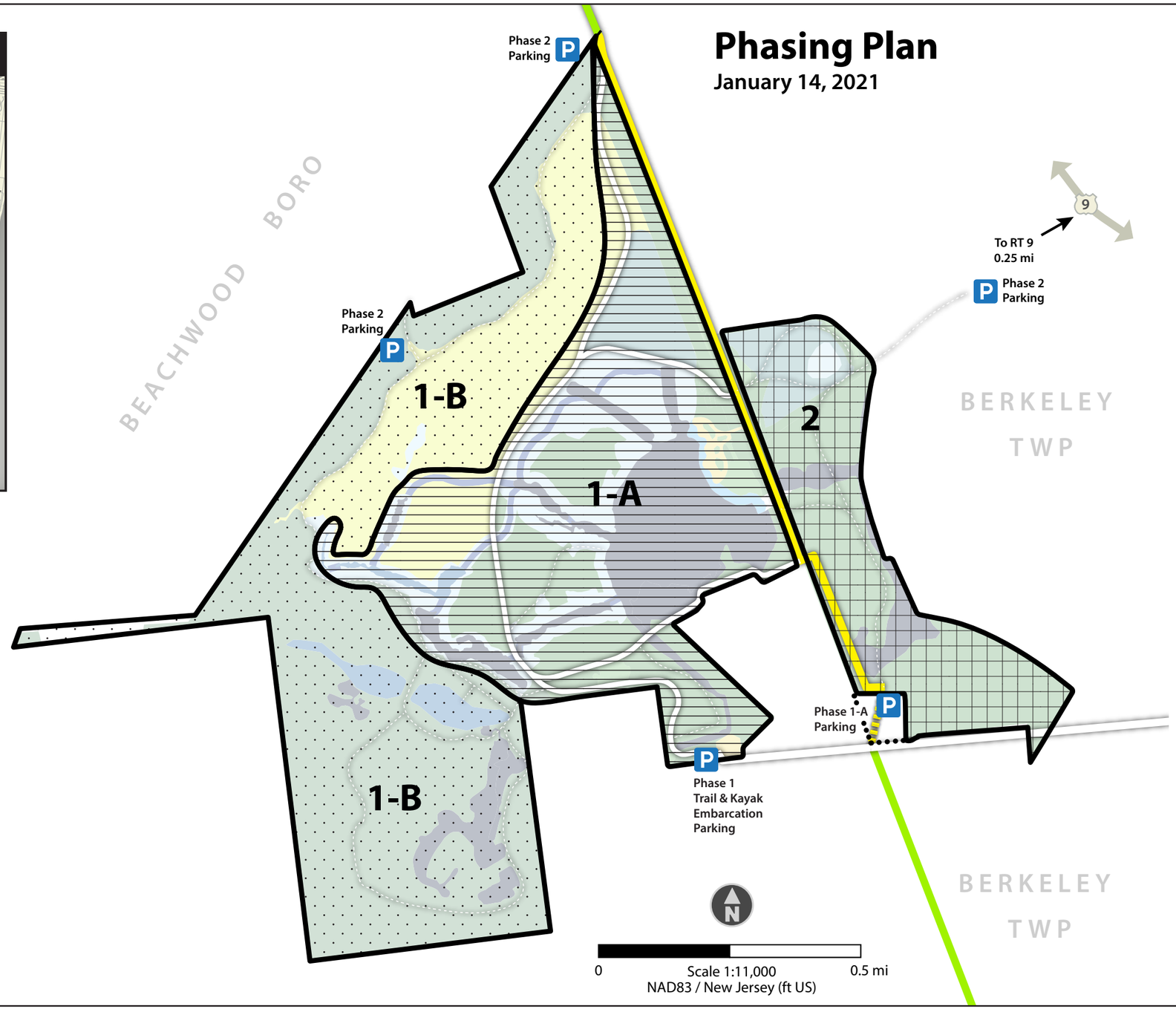

FIGURE 27: *Shows proposed phasing of land restoration and trail construction activity. The Pulverizing site can be opened to the public once Phase I is complete. This includes work identified in Section 4, principally: parking, trail construction (land and water), excavation of the lake fingers, regrading of for ephemeral and emergent wetlands, fishery improvements, the main lake - Mill Creek connector and the lakeshore public access area. Phase 2 work includes grassland and improvements to the emergent wetlands located east of the Barnegat Branch Trail.*

NEXT STEPS

Following submittal of the "Comprehensive Management Plan for the Former New Jersey Pulverizing Tract" to Ocean County, the steps outlined below should be considered as a road map for implementation:

1. Review of Comprehensive Management Plan by Commissioners and key departments;
2. Completion of special design area studies with additional key department review;
3. Preparation of phased development plan, integration with Barnegat Branch Trail construction;
4. Scheduling of permit pre-application meetings with NJDEP;
5. Completion of survey (topo), site plans, preliminary engineering, and utility coordination;
6. Development of probable cost estimates and material (unit) requirements for construction;
7. Review and adoption of financial plans for construction phases;
8. Preparation of final engineering plans, bid specifications for construction;
9. Issuance of regulatory permits for phased work; and
10. Publication of bid, award, and issuance of contractor Notice to Proceed for construction.

PROPOSED SCHEDULE FOR PHASE 1A-1B

	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
	Q1	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*
Site Assessment	■																			
Engineering Design (30%)		■																		
Engineering Design (60%)			■																	
Engineering Design (100%)				■																
Permitting				■																
Preparation of Bid Specs				■																
Construction Bid Process					■															
Permit Approval					■															
Phase 1A-1B Construction						■	■	■	■											
Construction - Planting (Seasonal Dependent)										■	■									
Post-construction Monitoring														■	■			■	■	

REGULATORY REVIEW

The implementation of the proposed conservation management plan as outlined in Section 4 will require multiple approvals of the New Jersey Department of Environmental Protection (NJDEP). This section provides a summary of regulated features such as: freshwater wetlands, freshwater wetlands transition areas, State open waters, flood hazard areas and riparian zones along with anticipated approvals to implement the plan.

Although portions of the site are regulated it is important to understand that, due to the degraded condition of regulated areas within the Pulverizing site, the project's objective of creating habitat will enhance long-term ecological uplift within regulated areas. As such, NJDEP regulations take stock of and account for beneficial outcomes on damaged lands. In addition, public access and recreational use atop restored lands is taken into consideration during the permit process. Finally, State Coastal Zone management policies encourage that coastal open space – including natural, scenic, historic and ecologically important landscapes – be preserved, enhanced and restored.

For the Pulverizing site, applicable state regulations include: Coastal Area Facility Review Act (CAFRA); Freshwater Wetlands Protection Act; Flood Hazard Area Control Act; Stormwater Management Rules; and Dam Safety Standards. In addition, approval from the Ocean County Soil Conservation District will be required for an Erosion and Sediment Control Plan pursuant to the New Jersey Pollutant Discharge Elimination System (NJPDES). A stormwater management plan must conform to the updated Stormwater Management Rule and will be applied to the improvements required for parking and trail / kayak embarkation areas.

The following sections will describe the permits anticipated for the implementation of this plan.

A. Freshwater Wetlands Protection Act

Any proposed activity within freshwater wetlands, adjacent transition area or State open water will require a Freshwater Wetlands Protection Act permit. Regulated activities include, but are not limited to, soil disturbance, disturbance of the water level, discharge of fill, placement of obstructions or structures and plant removal. The rules apply to all project elements described in Section 4 under Habitat Creation. Although the extent of regulated activities needed to implement this plan may be substantial, the work can be accomplished pursuant to Freshwater Wetlands General Permit No. 16. This permit is routinely applied for the implementation of a "comprehensive plan for the restoration, creation or enhancement of the habitat and water quality functions and values of wetlands, transition areas, and/or State open waters" [See, NJ Freshwater Wetlands Protection Act Rules, Pg. 90-91]. For the purposes of this permit a project 'sponsor' is required such as the United States Fish and Wildlife Service, the U.S. Department of Agriculture's Natural Resources and Conservation Service or a charitable conservancy.

Other regulated activities include the creation of the ramp for kayak and canoe access proposed at the parking and embarkation area. This regulated activity can also be accomplished through the Freshwater Wetlands General Permit No. 19. In addition, General Permit 17 will be needed for any new segment of trails or boardwalks that encroach into wetlands or wetland transition areas. To the degree proposed trails follow existing – disturbed – roads then additional permitting is not triggered. General Permit No. 11 may also be needed for discharge of stormwater from the parking and embarkation area.

B. Flood Area Hazard Control Act

The site includes waters, flood hazard areas and riparian zones regulated by the Flood Hazard Area Control Act. All open waters that connect – or are connected to – the lake and drainage areas greater than 50 acres fall under the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13), which defines flood hazard areas as, "land, and the space above that land, which lies below the flood hazard area design flood elevation." The riparian zone is defined at 7:13-4.1 as, "land and vegetation within and adjacent to a regulated water." As the Pulverizing site's flood hazard area has not been determined, an accepted method for determining the hazard area will be required for all regulated waters within.

Additional regulated activities include the alteration of topography through excavation, grading and/or placement of fill, cutting of vegetation in a riparian zone, creation of impervious surface, and the construction, reconstruction, repair, alteration, enlargement, elevation, or removal of a structure. The Flood Hazard Area Act Rules apply to the proposed replacement of the culvert under the Barnegat Branch Trail to improve the connection between the main lake and Mill Creek. Replacement of the existing culvert with an open bottom culvert or bridge could be accomplished under a Flood Hazard Area General Permit No. 10 which authorizes reconstruction of an existing culvert. This activity may also fall within the scope of activities covered by Flood Hazard Area General Permit No. 4 for the creation, restoration and enhancement of habitat and water quality value and function. The above-referenced permit will be required for restoration work in riparian zones or regulated waters.

The parking and embarkation area will undergo permitting review, the result of more than 0.25-acre of impervious surface placement. Under the new stormwater rules, runoff must be treated by green infrastructure utilizing Best Management Practices (BMPs) prior to discharge to surface waters. Finally, discharge of stormwater to a regulated water may necessitate an Individual Flood Hazard Permit depending on the area of riparian zone impact.

C. Dam Safety Standards

The former railroad embankment underlying the Barnegat Branch Trail functions as a dam as defined by the Dam Safety Standards and will require a permit to replace the existing culvert with an open span as set forth in Section 4 B7. The daylighting of the stream will require a dam safety permit as well as a Freshwater Wetland General Permit 18 – Dam Repair. In addition to the repair of dams, General Permit 18 includes provisions for the removal or modification of a dam.

D. Coastal Area Facility Review Act

Although the site lies within the CAFRA regulatory area, restoration work contemplated for the initial phase of the project will not be regulated. However, and as noted, development of the parking and embarkation area will trigger a CAFRA permit. At a minimum, this part of the project will require Coastal Zone General Permit 13 – construction of recreational facilities at public parks. This permit covers a variety of park features such as pathways, bicycle paths, jogging and nature trails, gazebos, rain shelters and sheds (with a footprint of 200 square or less) and restroom facilities. Complete permitting requirements will await review of complete facility design plans.

E. General NJDEP Permit-Related Constraints

Plan implementation may be complicated due to the presence of threatened and endangered species. Natural Heritage Database and Landscape Project Version 3.3 results (Natural Heritage Program NHP File No. 19-3907482-17169, July 26, 2019) indicates the following rare wildlife species/habitat presence on the site: State Threatened black-crowned night-heron (*Nycticorax nycticorax*); foraging and State Threatened northern pine snake (*Pituophis melanoleucus*), occupied habitat. Additionally, the NHP results indicate presence of the following rare wildlife species/habitat within the immediate vicinity of the site: State Threatened barred owl (*Strix varia*), breeding sighting; State Threatened black-crowned night-heron, foraging; and State Threatened northern pine snake, occupied habitat. The database was informed, in part, by a comprehensive habitat evaluation, general wildlife inventory and intensive Threatened and Endangered species survey conducted in 2004 by Herpetological Associates, Inc., in support of the proposed Western Boulevard extension project. Notably, this survey identified a viable population of northern pine snake in the vicinity of the site. The presence of Northern pine snake will likely be the species of greatest regulatory interest. Beneficially, the area planned for grassland creation will work to enlarge and enhance the habitat available to this species.

The presence of listed species such as barred owl on or proximate to the site may also have implications for the resource value of wetland areas, and thus effect the width assigned to the transition areas. The presence of any wetland areas on or near the site that contains suitable breeding habitat for barred owl will likely be limited to mature forest communities such as the hardwood swamp or pitch pine lowland. Although these areas are proposed for preservation, placement of a trail in wetlands will require that the "activities shall not destroy, jeopardize, or adversely modify a present or documented habitat for threatened or endangered species; and shall not jeopardize the continued existence of any local population of a threatened or endangered species."

F. Permit Application Process

Although permits needed to implement the project are supported by NJDEP as desirable, it is recommended that a meeting be scheduled with the Office of Permit and Project Navigation (OPPN). This will allow the County to introduce the comprehensive nature of the project and obtain feedback from various bureaus regarding design questions and concerns. This will also allow the County the opportunity to review phasing of construction, especially if the project is anticipated to run more than five years from the date of permit issuance (limit of term).

G. Ocean County Soil Conservation District

Plan implementation involves disturbance of more than 5,000 square feet of land and thus triggers a Soil Erosion and Sediment Control Certification (SESC) from the Ocean County Soil Conservation District. This permit will be required for every phase of the project. As previously noted, a NJPDES construction Stormwater Permit will be needed as construction activities such as clearing, grading and excavating disturb more than one-acre during each phase of the project. A construction general permit (5G3) must be obtained from NJDEP after receipt of a Soil Erosion and Sediment Control Plan certification from the Ocean County Soil Conservation District.

DISCUSSION OF REGULATORY OBJECTIVES

Although the implementation of this plan contemplates a substantial amount of land modification within regulated areas, restoration of degraded habitat and development of public recreational use of the Pulverizing site is encouraged by NJDEP and its regulatory program. It is critical to acknowledge and balance the site's history of disturbance and existing degraded state with the opportunity for substantial ecological uplift. This plan was specifically developed with NJDEP's permit requirements in-mind, including the proposed integration of ecological uplift through the creation of additional open waters, wetlands, upland habitats, and extensive public access through a system of land and water trails.