



Alternatives Analysis, Engineering Design, and Construction Planning for a 10.5-Mile, Inland Drinking Water Canal: Delaware and Raritan Canal, New Jersey

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Overview

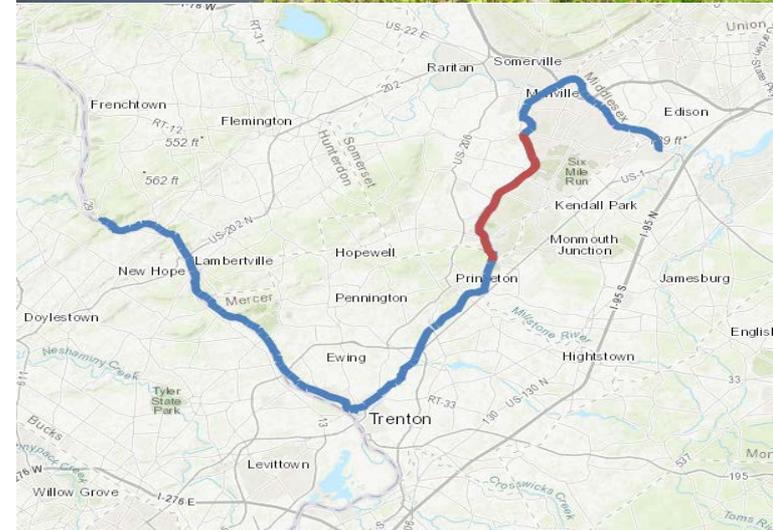
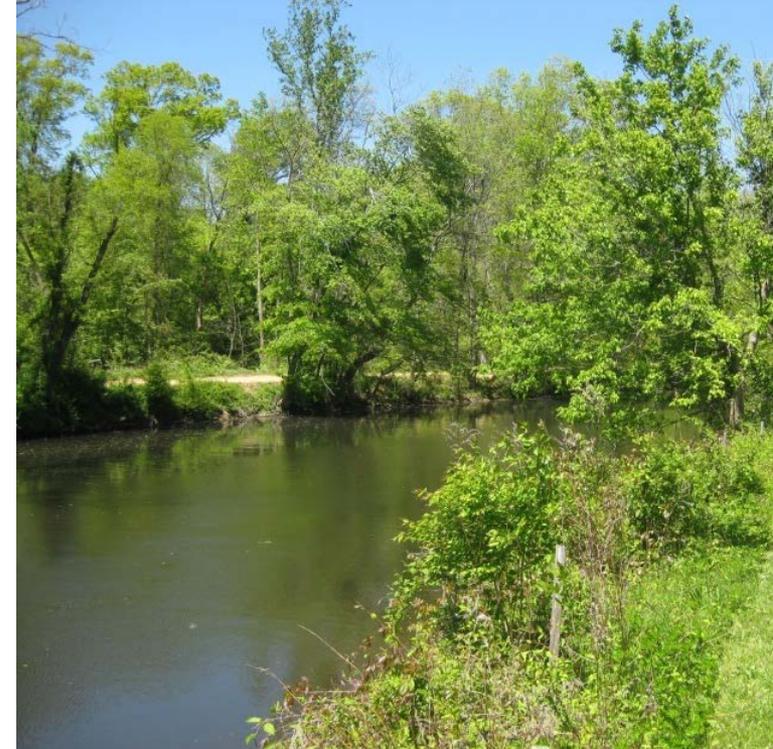
- 1 Site Background and Planning
- 2 Design Elements
- 3 Implementation
- 4 Next Steps

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Site Background and Planning

Delaware and Raritan Canal Overview

- The Canal provides a drinking water source for municipal water works servicing millions of customers in central New Jersey
- Maintained by New Jersey Water Supply Authority
- Project involves removing sediment along an approximately 10.5-mile stretch of the Canal from Kingston Lock to Amwell Road



Project Purpose and Goals

Purpose and Need

- Maintain water supply

Project Objectives

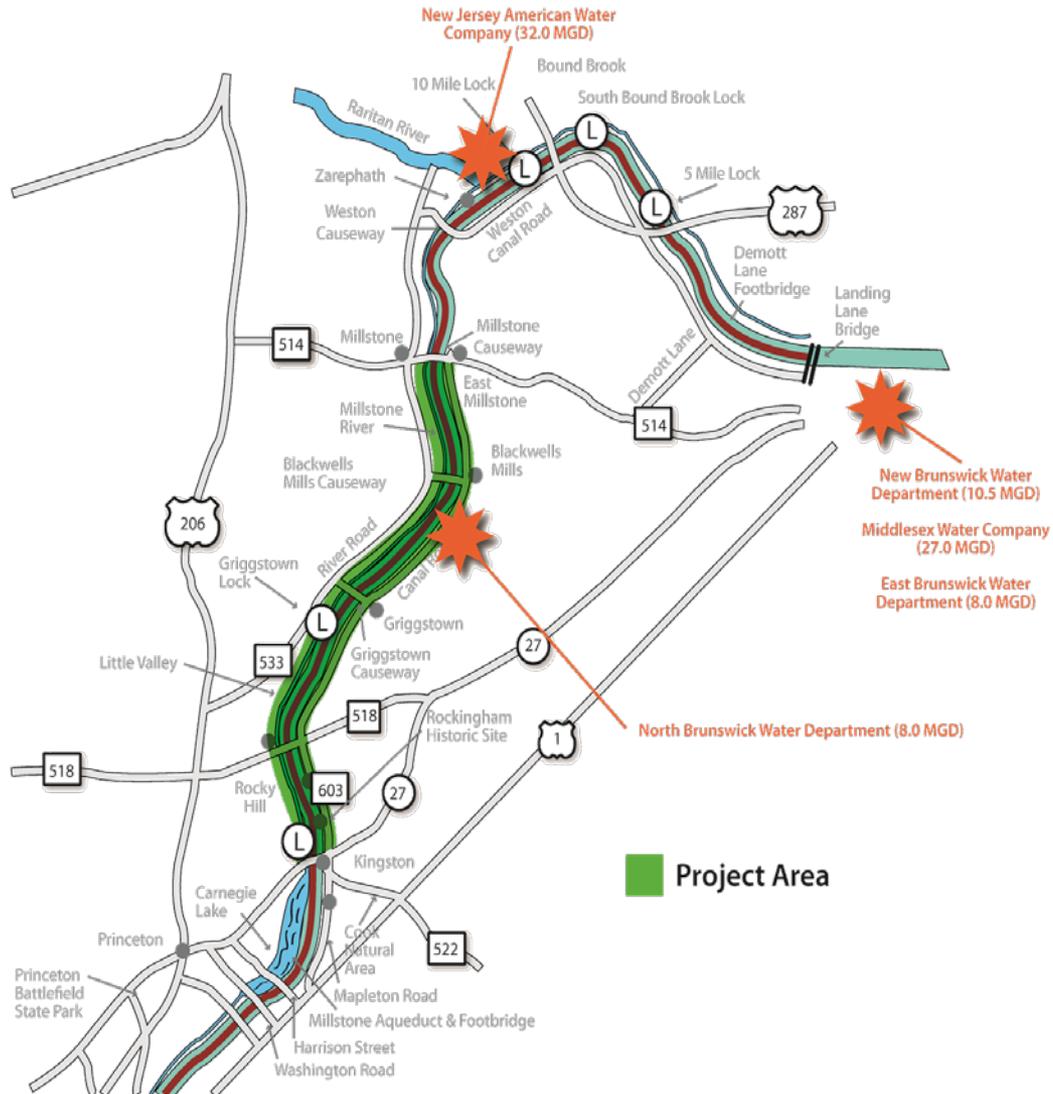
- Remove 248,000 CY of sediment from the Canal in order to restore flow capacity
- Remove 47,000 CY of historically-dredged material from NJWSA stockpile site

Project Goals

- Protect the historical integrity of the Canal
- Protect existing structures
- Minimize environmental and community impacts
- Conduct focused outreach to public officials and stakeholders



Project Area



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Design Elements

Sediment Removal Methodology Selection

- Dredging technologies evaluated
 - Mechanical excavation
(in the dry)
 - Mechanical dredging
 - Hydraulic dredging with mechanical dewatering
 - Hydraulic dredging with geobags
- Historic small-scale maintenance events

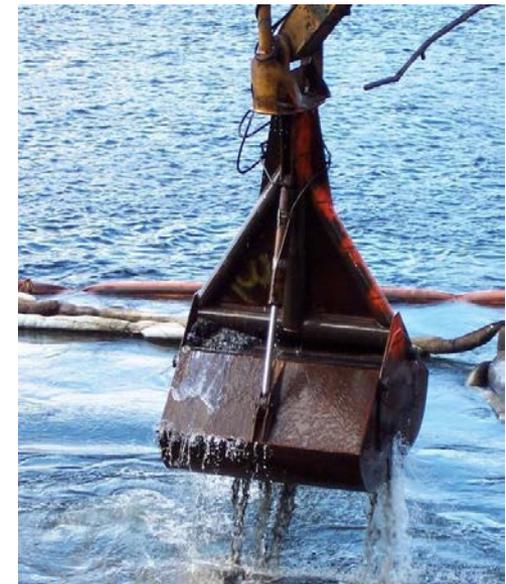
Mechanical Excavation (in the Dry)

- Segment Canal – each segment with an access area and truck ramp
- Bypass pipeline to maintain flow
- Low-ground pressure equipment
- Air dry and/or windrow material
- Higher degree of accuracy during removal (increased volume control) depending on material dryness
- Dropped from further consideration due to traffic, pipeline, equipment, and community disturbance issues



Mechanical Dredging

- Hydraulic excavator operating from shallow-draft barge or flexi-float platform
- Hydraulic clamshell bucket
- Dredge maneuvering with non-penetrative methods to preserve clay liner
- Dredged sediment placed to small scows or containers on flexi-floats
- Dropped from further evaluation due to traffic and cost based considerations



Hydraulic Dredging with Mechanical Dewatering

- Hydraulic cutterhead dredge
- Separate SAV and debris removal operations prior to dredging
- Dredge maneuvering with non-penetrative methods to preserve clay liner
- Booster pumps required
- One access area per canal reach
- One dewatering and staging area
- Water treatment/water management operations prior to discharge to achieve permit conditions
- Minimal impacts to community and recreational users



Hydraulic Dredging with Geobag Dewatering

- Hydraulic cutterhead dredge
- Separate SAV and debris removal operations prior to dredging
- Dredge maneuvering with non-penetrative methods to preserve clay liner
- Booster pumps required
- One access area per canal reach
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Project Permitting

Environmental and Aesthetic Concerns	Dredge Methodology		
	Mechanical Dredging (in the wet)	Mechanical Excavation (in the dry)	Hydraulic Dredging
Canal Draining	○	●	○
Staging Areas	◐	◐	◐
Access Areas	◐	●	○
Tree Clearing	◐	●	○
Tree Trimming	◐	◐	◐
Wetland and Wetland Transition Area Impacts	◐	●	○
Species Relocation/ Restocking	○	●	○
Flood Hazard Area Disturbance	◐	●	○
Traffic	●	●	○
Cultural Resources	◐	○	◐
Trail Closures/ Recreational Impacts	○	●	○

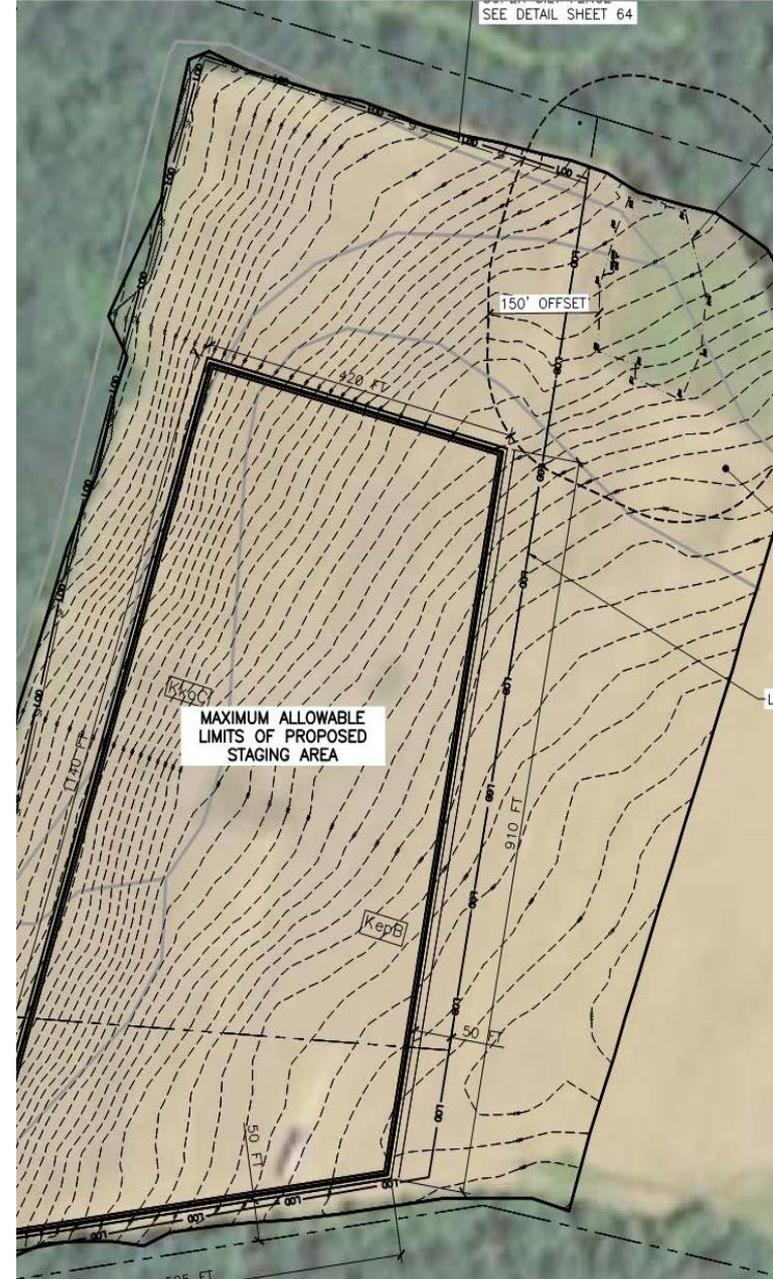
Required Permits

- USACE – NWP 24
- Delaware and Raritan Canal Commission
 - GP no. 1 – Maintenance and Repair of Existing Features
- NJ Department of Environmental Protection
 - Freshwater Wetlands; GP no. 1 and no.3
 - Individual Flood Hazard Permit
 - No Net Loss Reforestation Act Compliance
 - NJDEP-SHPO Section 106 Consultation
 - NJDEP Air Permit
- Somerset and Hunterdon County Soil Conservation District
- Franklin Township Local Permits

●	◐	○
Major	Moderate	Minor

Selected Approach

- Hydraulic Dredging
- Single, centrally located Staging and Dewatering Area
- Performance based requirements for dewatering



Pre-Design Investigations



- Initial Site Reconnaissance
- Sediment sampling for physical and chemical properties
- Bench scale dewatering and stabilization testing
- Site bathymetric and topographic surveying

Physical Properties of Sediment



- Average silt and clay content of 65% (30% to 94%)
- Average sand content of 29% (6% to 37%)

Bench-Scale Testing Results

- Testing performed in 2010 and 2016
- Amended with Portland Cement
 - Targeted initial dosage rate of 8% by wet-weight basis



Beneficial Use Analysis

Dredge Material Characterization

- Chemical analysis of the target materials meet New Jersey non-residential re-use standards
- Majority of material meets NJ residential re-use standards
- Vanadium and benzo(a) pyrene observed in some samples
- Elutriate samples from bench-scale dewatering tests concluded that direct discharge to the Canal would achieve surface water standards
- Treatment limited to removal of suspended solids and residual polymer(s)

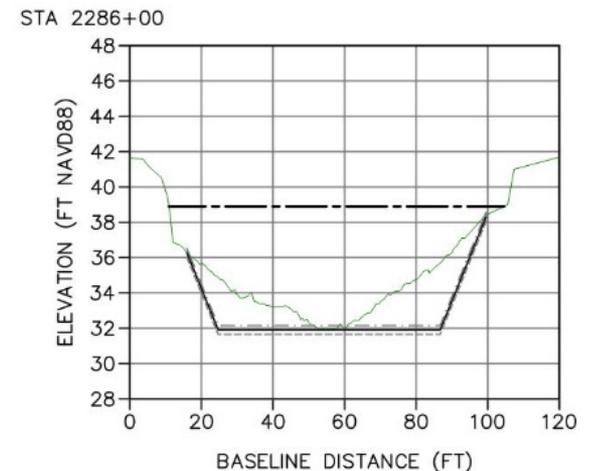
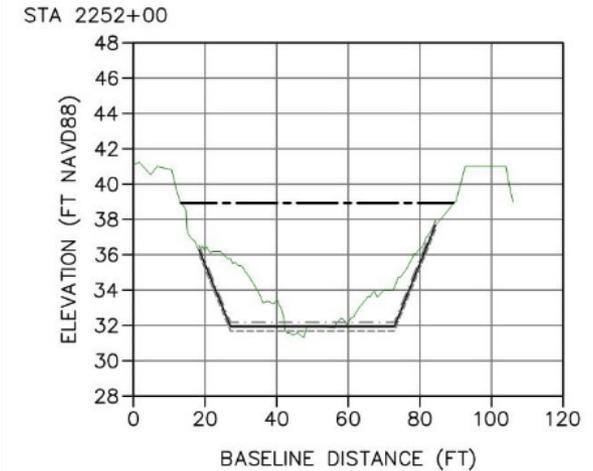


Beneficial Reuse of Dewatered Sediments

- American Cyanamid Site in Bridgewater Township, New Jersey
 - Use as grading fill to support site closure cap
 - Analytical and chemical testing requirements
 - Sufficient fill need to accept full project volume
- Alternate facilities to receive non-BR material, if necessary

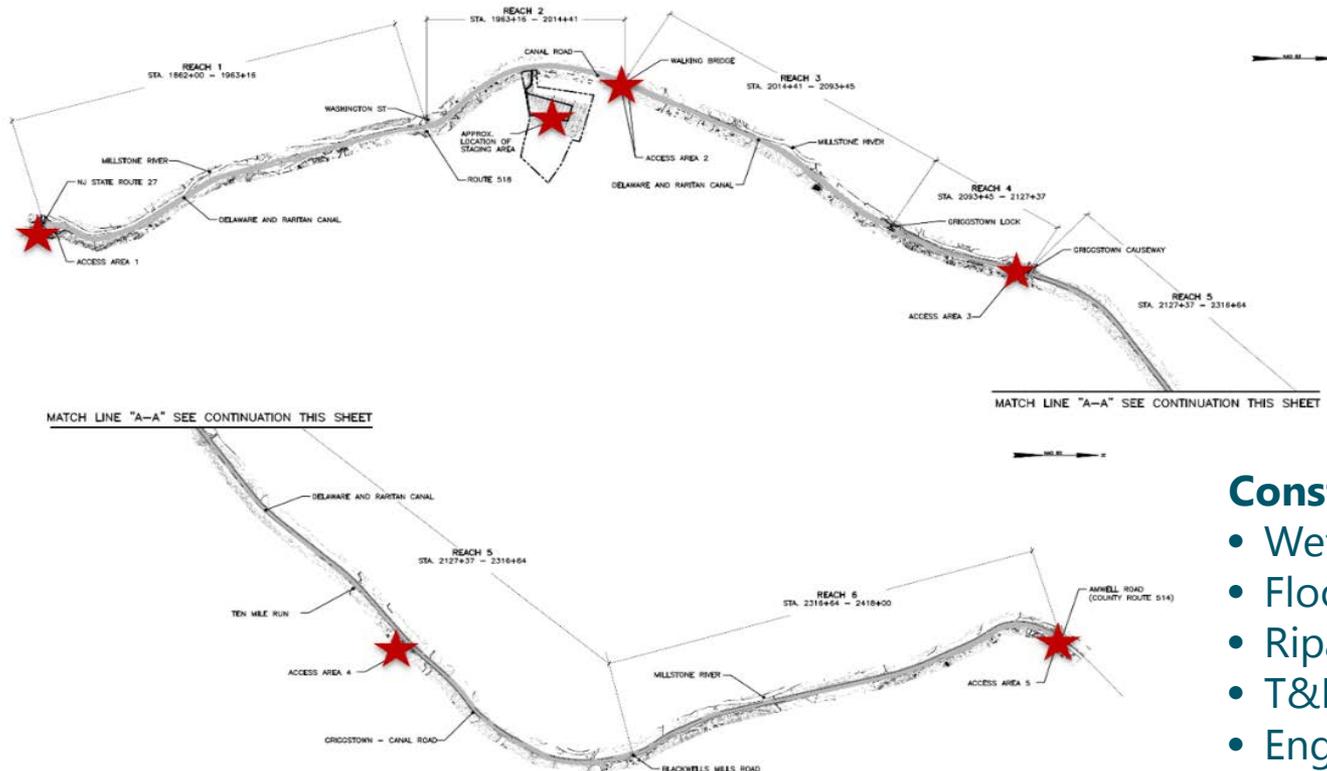
Dredge Prism Development

- Restore minimum 7-foot water depth in the Canal
- Clay liner protection
- ± 3 -inch overdredge allowance
- 2:1 side slopes
- 10-foot horizontal offset from structures



Design – Access Area Selection Process

- Canal segmented into six reaches
- Centrally located Staging Area – 8.1 acres for dewatering pad construction
- Access Areas – 5 access areas to Canal for equipment and materials mobilization



Constraints

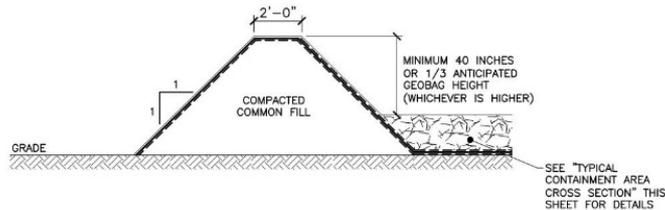
- Wetlands and Transition Areas
- Flood Hazard Area
- Riparian Zone
- T&E Species
- Engineering Constraints

Design – Example Access Area (AA2)



Design – Project Staging and Dewatering Area

- Cultural resources related constraints
- NJDEP-FHA no-rise analysis

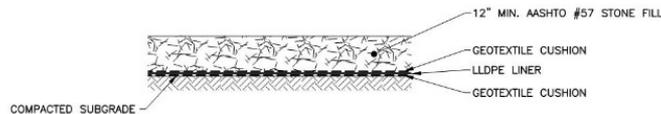


DETAIL NOTE:

1. THE CONTRACTOR SHALL DETERMINE ACTUAL ALIGNMENT OF BERMS AND FINAL BERM DIMENSIONS BASED ON THE PROPOSED DEWATERING PROCESS.

**TYPICAL STAGING AREA
CONTAINMENT BERM DETAIL**

NOT TO SCALE



DETAIL NOTE:

1. THIS DETAIL REPRESENTS THE MINIMUM PAD REQUIREMENTS FOR GEOBAG BASED DEWATERING. THE CONTRACTOR SHALL PROVIDE DEWATERING PAD DIMENSIONS AND COMPONENTS APPROPRIATE FOR HIS PROPOSED OPERATION.

**TYPICAL STAGING AREA
DEWATERING PAD CROSS SECTION**

NOT TO SCALE



Timing Restrictions

- Tree Trimming Period
 - October 1 – March 31
- In-Water Working Period
 - July 1-October 31
- Stockpile Area Working Period
 - August 1 – December 14
- General Construction Hours
 - Monday-Friday 7:00am-6:00 pm
 - Saturday 9:00am-6:00pm
- Hauling Restrictions
 - Monday-Friday 9:00am -3:30pm



Environmental Impact Mitigation Measures

	Potential Restriction	Restriction Dates	Mitigation/Constraint
Indiana bat	Tree trimming and removal	April 1 to September 30	Adhere to restriction as applicable
Bald eagle foraging	Tree trimming and removal	March 15 to June 30	Nest in Princeton, New Jersey may no longer be viable
Wood turtle	All In-water activities (Sta 2170+00 to 2280+00)	November 1 to April 1	Sequence work to achieve restriction
	All land-ward activities (Sta 2170+00 to 2280+00)	March 15 to November 15	Sequence work and qualified herpetologist onsite
Cooper Hawk	Tree trimming and removal (Vicinity of nest only)	March 1 to July 15	In vicinity of nest only
Warm water fisheries/pickerel	All In-water activities	April 1 to June 30	May be waived by NJDEP
Migratory birds	Tree trimming and removal	April 15 to September 15	Sequence work to achieve restriction

Project Timeline

- Design finalized in June 2017
- All permits received in October 2017
- Pre-Qualification process for potential bidders
- Bids opened in November 2017
- J.F. Brennan awarded dredging contract in December 2017
- Site mobilization in March 2018

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Implementation

Mobilization and Site Set-Up

- Site mobilization in March 2018
- Tree trimming operations March to April 2018
- Access Area and Staging Area construction during May 2018 to present
- Start of in-water work in early July 2018



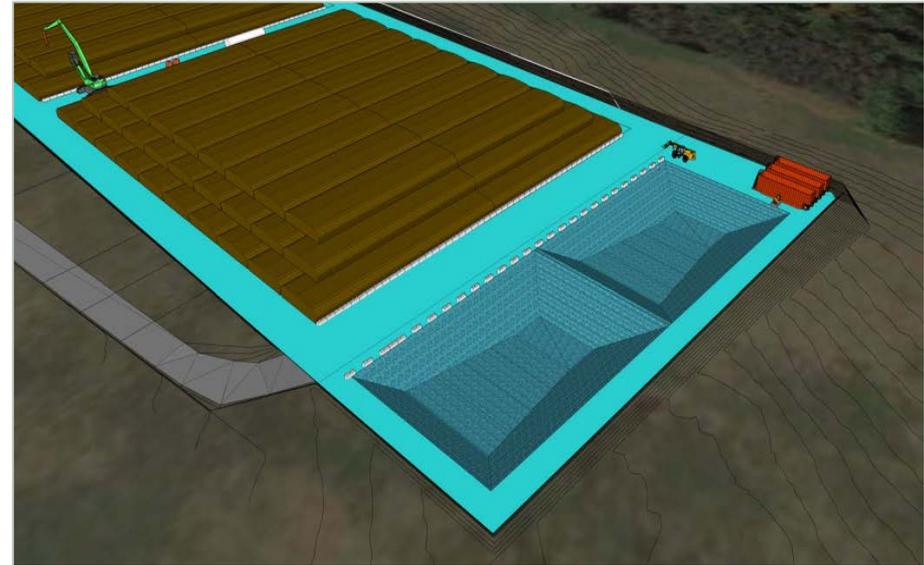
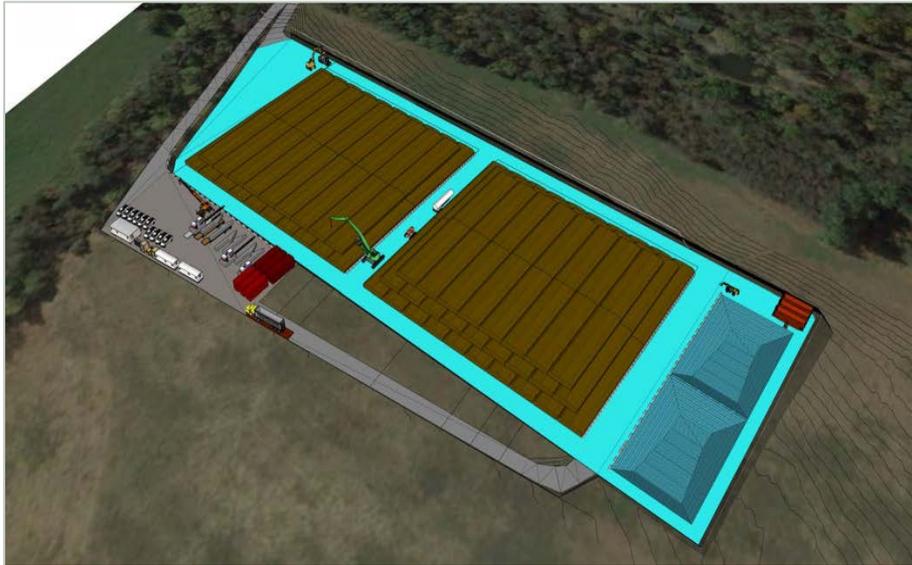
Access Area Construction

- Construction began April 2018
- Site earthwork and grading
- Equipment mobilization
- Dredge pipeline to Canal
- Pre-construction surveying and site layout



Staging Area Planning

- Brennan utilized 3D modeling to balance the cut/fill earthwork and layout dewatering/sediment management operations



Staging Area Construction



Staging Area Construction (cont.)

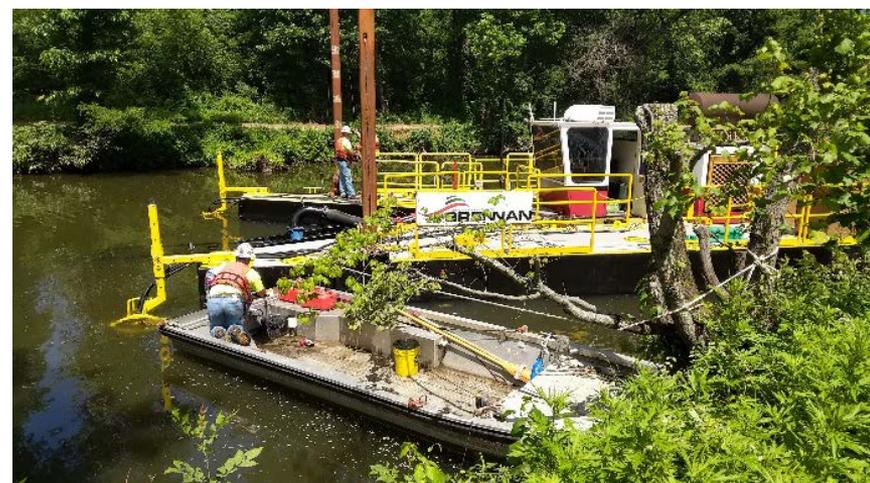


Staging Area Construction (cont.)



Pipeline and Dredge Mobilization

- Two dredges and support equipment launched in June 2018



Implementation Schedule

- 2018 Dredging Season
 - Complete dredging in Reaches 1, 2, and 4
 - Partial dredging in Reach 3
 - Three dredges working concurrently in upstream 4.9 miles
- 2019 Dredging Season
 - Balance Reach 3 and partial dredging in Reach 5
- 2020 Dredging Season
 - Balance of Reach 5 and Reach 6
- Dewatering using geobags

4 Next Steps

Next Steps

- Dredging begins July 2018
- Complete dredging operations November 2020
- Site restoration and demobilization in Spring 2021
- Full length of Canal is 60+ miles
 - Current project targets most impacted water depths over 10 mile stretch
 - Larger-scale dredging events likely needed in future, in addition to ongoing maintenance

Questions?
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