

Flat Rock Dam — Manayunk Canal Betterment Project

Water Quality | Safety | Ecological Integrity

AWWA PA Section | Fall 2023 Joint Technical Conference
Tuesday, October 24th, 2023 | 1:30 PM

PHILADELPHIA
WATER
— DEPARTMENT —



Rowan University

HENRY M. ROWAN

COLLEGE OF ENGINEERING

VILLANOVA UNIVERSITY

COLLEGE OF ENGINEERING



**CENTER FOR RESILIENT
WATER SYSTEMS**

Ian McKane, EIT

B.S. Civil Engineering

M.S. Civil Engineering

(Spatial and Temporal Trends in Infiltration, Soil Texture, and Nutrient Accumulation in Rain Gardens)

Construction Project Engineer for Flat Rock Dam

**PHILADELPHIA
WATER**
— DEPARTMENT —

Outline

1. Project Background and History
2. Water Quality Improvements
3. Construction Timeline & Community Impact

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Philadelphia County

Manayunk Canal
Schuylkill River

Montgomery County



Layers

Google 100%

600 m Camera: 5,043 m 40°01'56"N 75°14'09"W 15 m



Philadelphia County

Montgomery County

Schuylkill River

Manayunk Canal

Manayunk Canal

Elite Sports Factory

CHO Care

Layers

3D



FLAT ROCK DAM MAIN SPILLWAY
OWNED BY THE COMMONWEALTH OF PENNSYLVANIA

INLET CANAL WALL

MANAYUNK INLET CANAL

FISH LADDER OWNED BY THE
COMMONWEALTH OF
PENNSYLVANIA

SCHUYLKILL RIVER
(WATERS OF THE U.S.)



LOCK NO 68

MANAYUNK
CANAL

FEEDER STRUCTURE



1. Project Background

Mission Statement

Design Rationale and Sustainability

Historic Features: Past to Present

Environmental Impacts and Benefits

Construction Updates

Project Timeline

1. Project Background

Project Mission

- To improve water quality in the Manayunk Canal
- To meet Dam safety compliance & regulations



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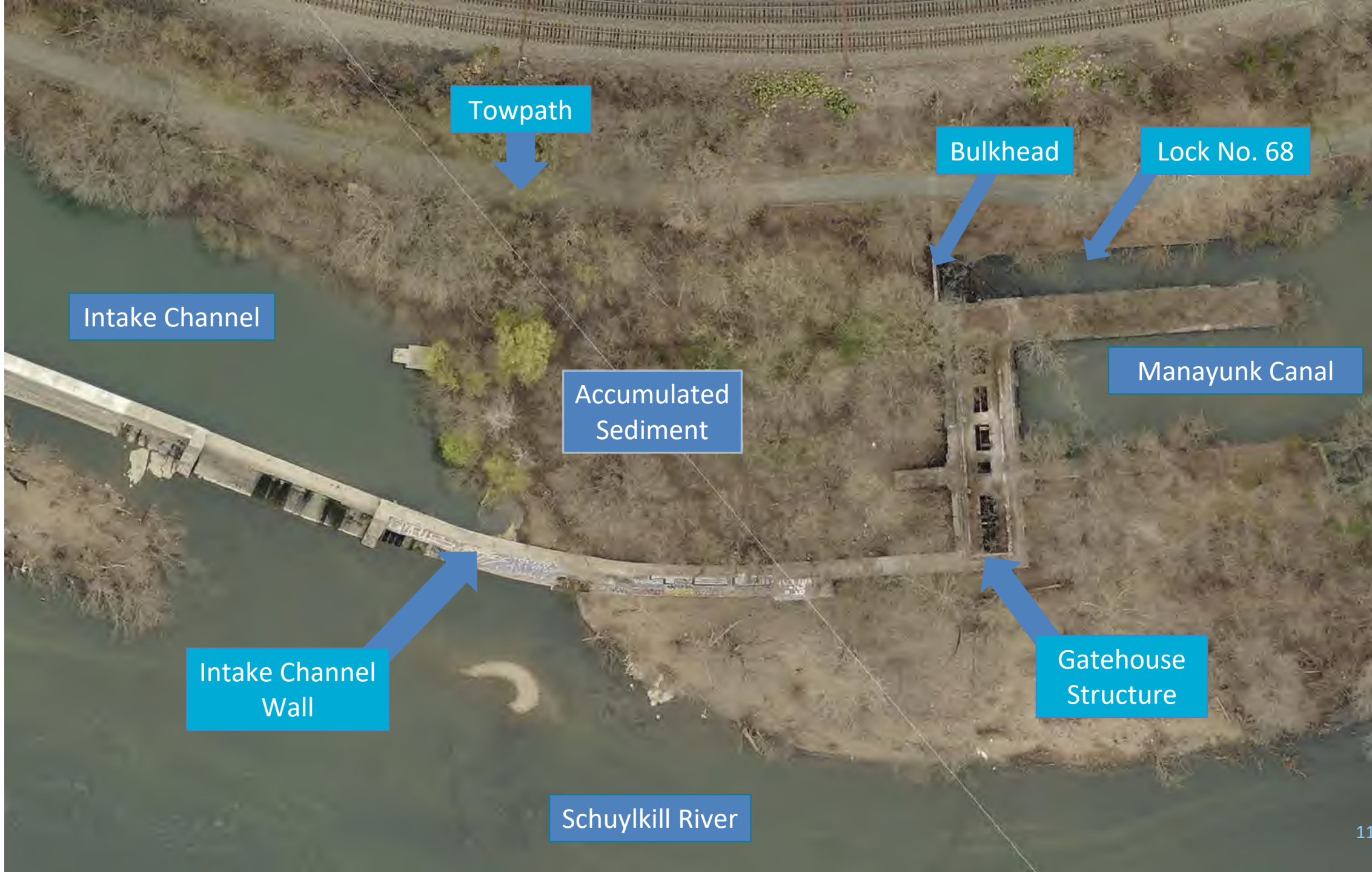
MANAYUNK
CANAL

LOCK NO 68

FEEDER STRUCTURE

Project background / Reasons for project

- Manayunk Canal has no connection to the Schuylkill River
- Canal is stagnant, leading to algae blooms and fish deaths
- Sediment, trash, and debris has accumulated upstream of the Gatehouse Structure
- Historic Gatehouse Structure has become unsafe
- Dam Repairs



Towpath

Bulkhead

Lock No. 68

Intake Channel

Accumulated Sediment

Manayunk Canal

Intake Channel Wall

Gatehouse Structure

Schuylkill River

Schuylkill Navigation Company Port Carbon to Philadelphia, PA

Over 130 miles



Flat Rock Dam
Constructed 1815
Re-Constructed 1909



*Flat Rock
Dam,
Fairmount
Park*

Historic Features in Manayunk Canal

- Feeder Gatehouse Structure
- Lock No. 68
- Towpath (Schuylkill River Trail)
- 1.75 mile long Manayunk Canal
- Lock No. 69, 70

Lock 68 and Feeder Structure Prior to 1918



Photo Courtesy of Adam E. Levine,
Historical Consultant, Philadelphia
Water Department

Lock 68 and
Feeder Structure
Circa 1918



Photo Courtesy of Adam E. Levine,
Historical Consultant, Philadelphia
Water Department

Critical Drivers for Project Design



- Chapter 105 – PADEP Dams and Waterways
- Chapter 93 – PADEP Water Quality Standards
- PENNVEST Funding

Sustainable Operations

- To be sustainable, the design solution must provide for:
 - Flow Control (Normal Operations and Flood Control) using manually operated gates
 - Debris collection and removal
 - Sediment management and removal
 - Regular inspections and maintenance

Existing Conditions



Towpath

Bulkhead

Lock No. 68

Intake Channel

Accumulated Sediment

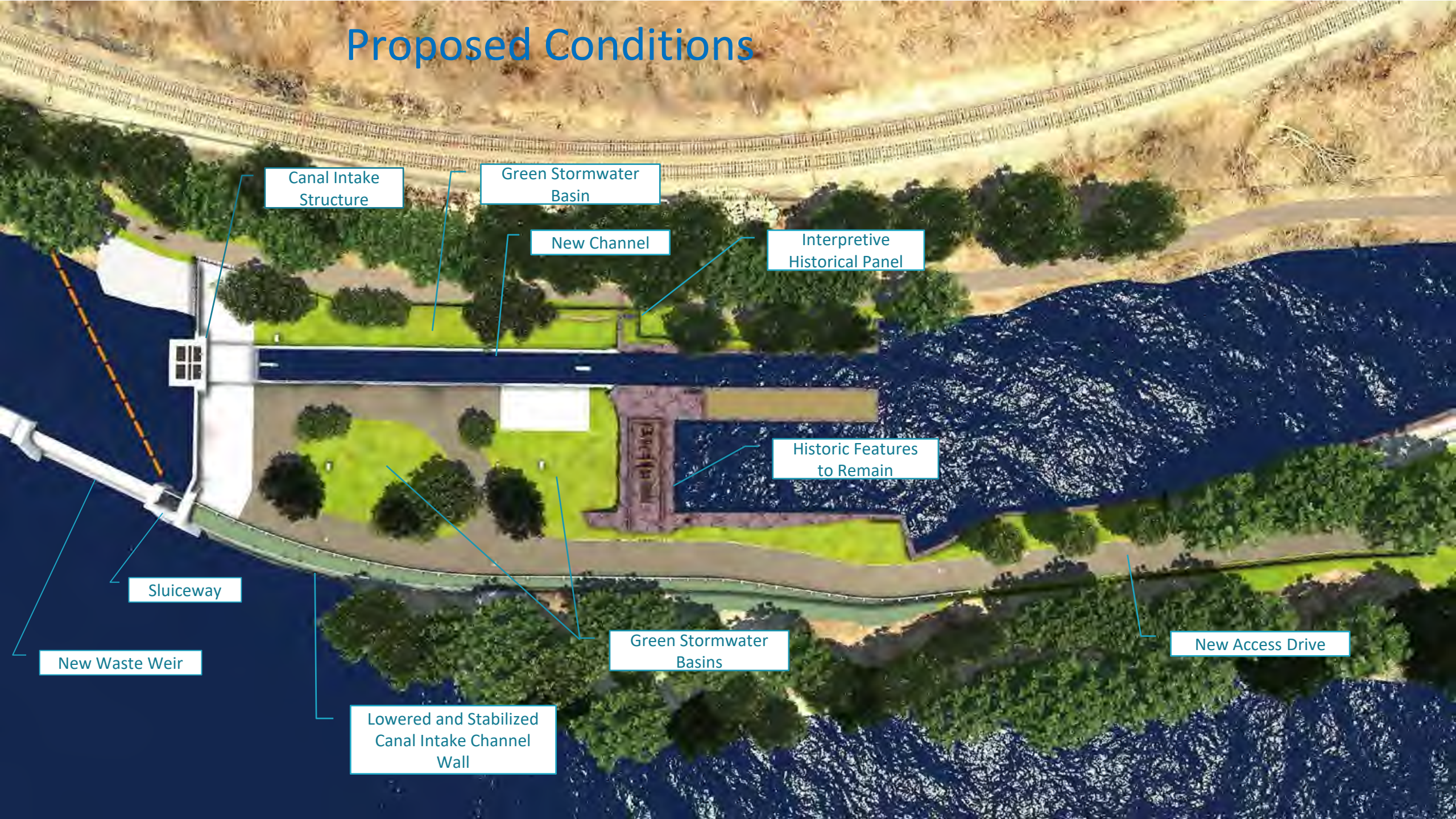
Manayunk Canal

Intake Channel Wall

Gatehouse Structure

Schuylkill River

Proposed Conditions



Canal Intake Structure

Green Stormwater Basin

New Channel

Interpretive Historical Panel

Historic Features to Remain

Sluiceway

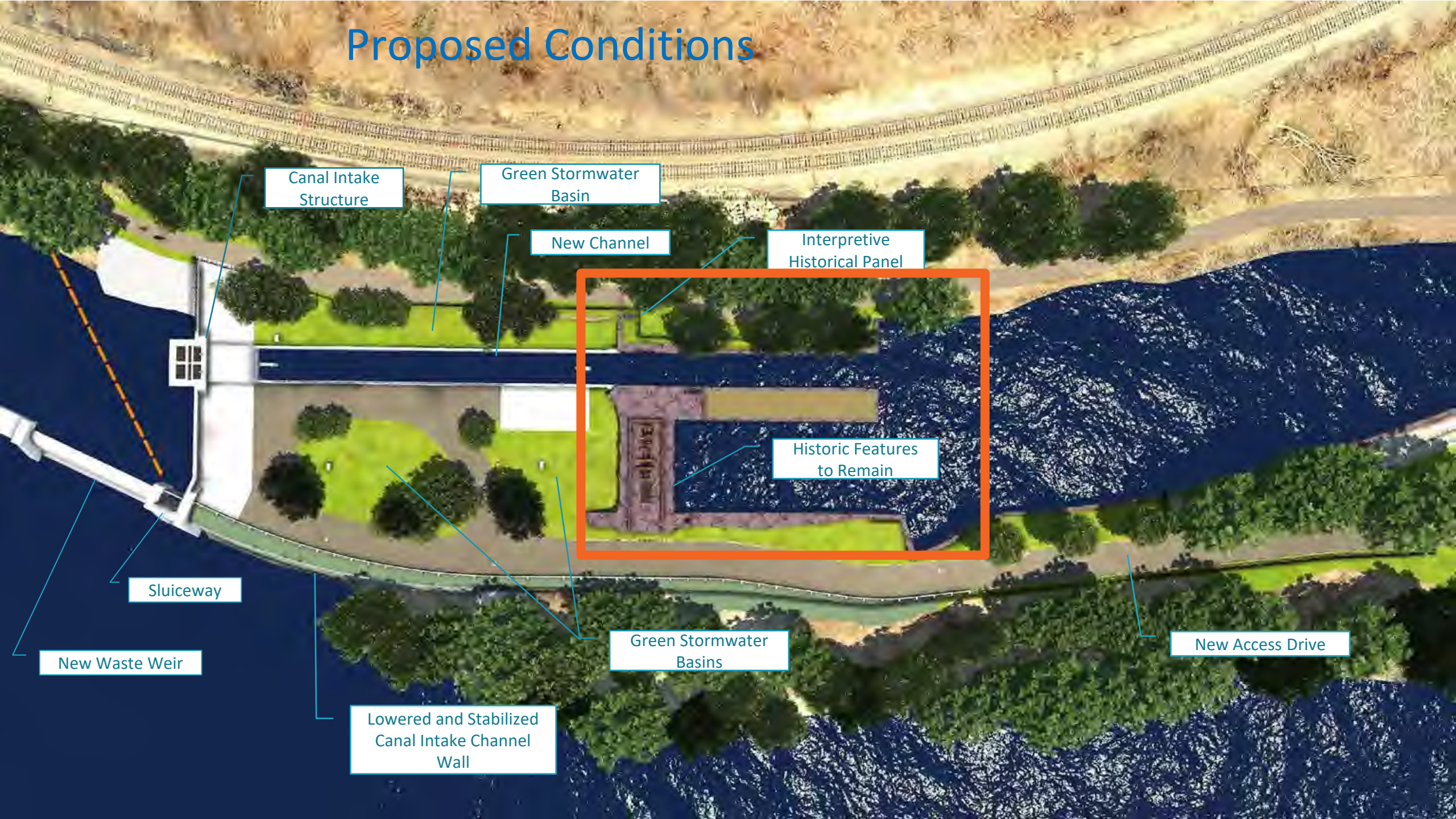
New Waste Weir

Green Stormwater Basins

New Access Drive

Lowered and Stabilized Canal Intake Channel Wall

Proposed Conditions



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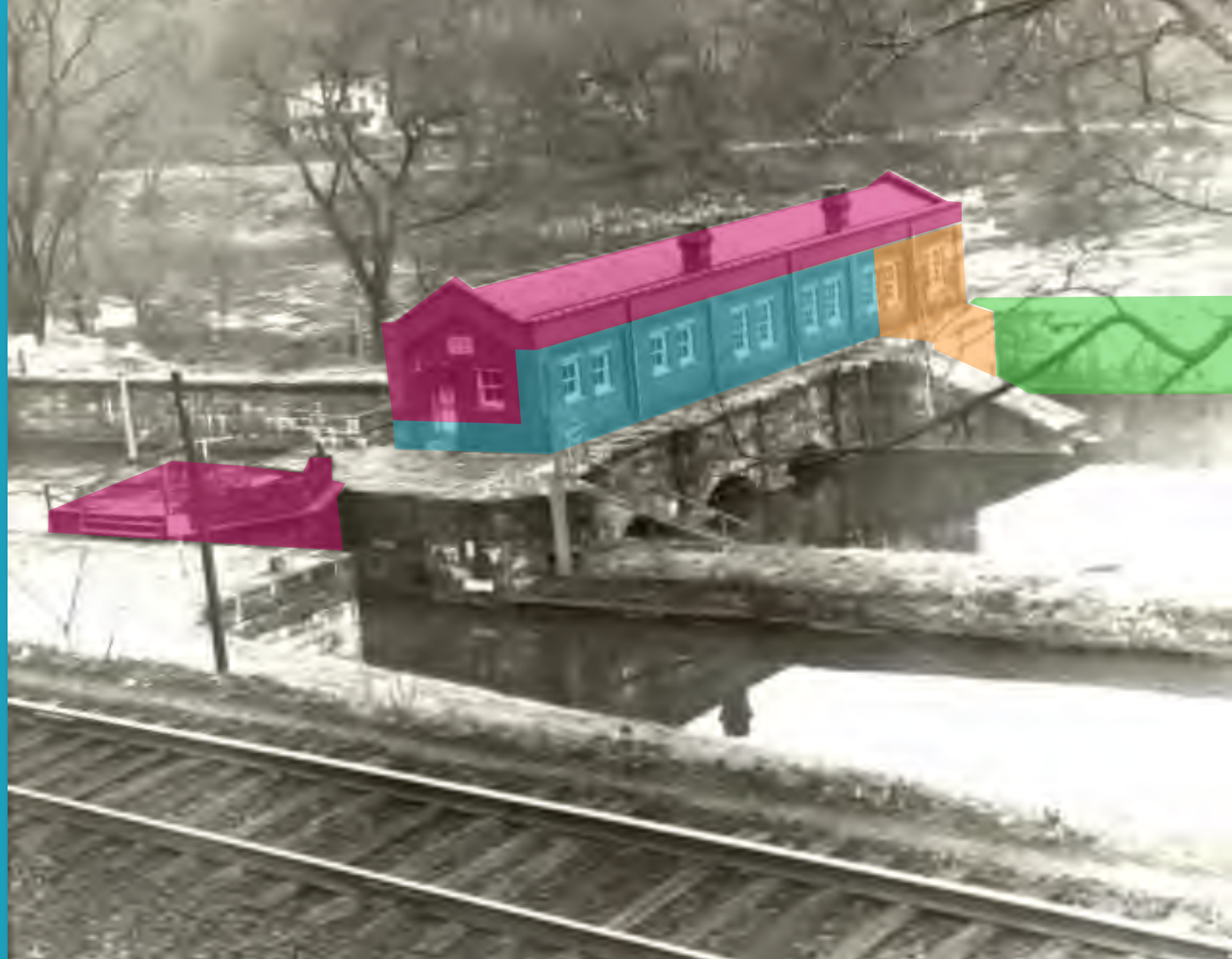
Lowered and Stabilized Canal Intake Channel Wall

Prior to Construction

Abandonment of Historic Features

- Canal ceased operations in the 1940s
- Lock gates were removed, and Lock 68 was bulkheaded in the 1970s
- Outlet arches of Feeder Structure were plugged
- Maintenance dredging and collection of debris ceased
- Brick Feeder Gatehouse was boarded up and abandoned

Existing Conditions and Adverse Effects



-  No Longer Exists
-  Extremely Deteriorated
-  Conflicts With New Configuration
-  Requires Stability Improvements

Photo Courtesy of Adam E. Levine, Historical Consultant, Philadelphia Water Department

Preservation and Mitigation

- Preserve what remains of pre-1918 structures - Lock 68 and Masonry Feeder Structure
- Cleaning (graffiti removal), Clearing of vegetation and Restoration of Preserved features
- Operating gears will be preserved in place to be seen from the towpath/trail
- Provide for interpretation of historic features from the towpath/trail
- Fencing to inhibit trespass







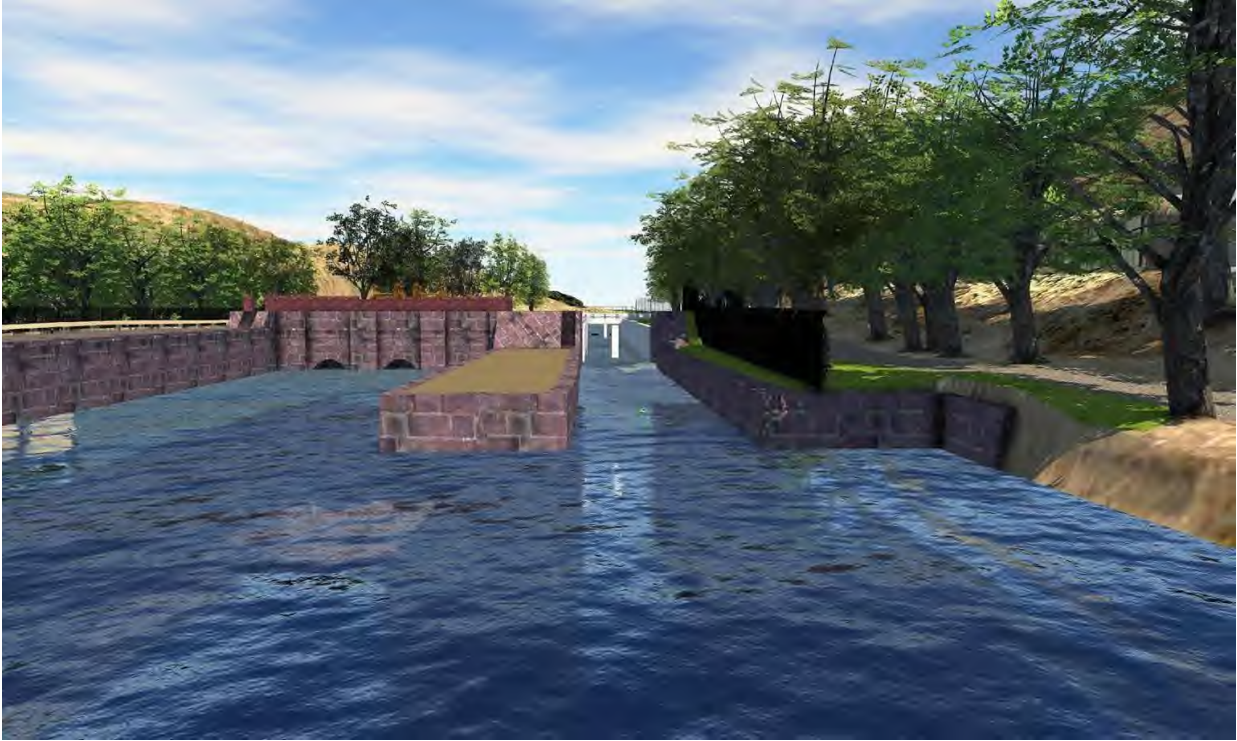




Upstream View from Sediment Area – Before and After



Downstream View of Lock – Before and After



View from Trail – Before and After



Above View - Pre- and Post-Construction



2. Water Quality Improvements

Flat Rock Dam - Manayunk Canal Improvements Project

Water Quality Concerns - *Algal Blooms*

- Frequent in Summer months
- Negative impact on water quality and aquatic organisms
- Taste and odor concerns for City's drinking water



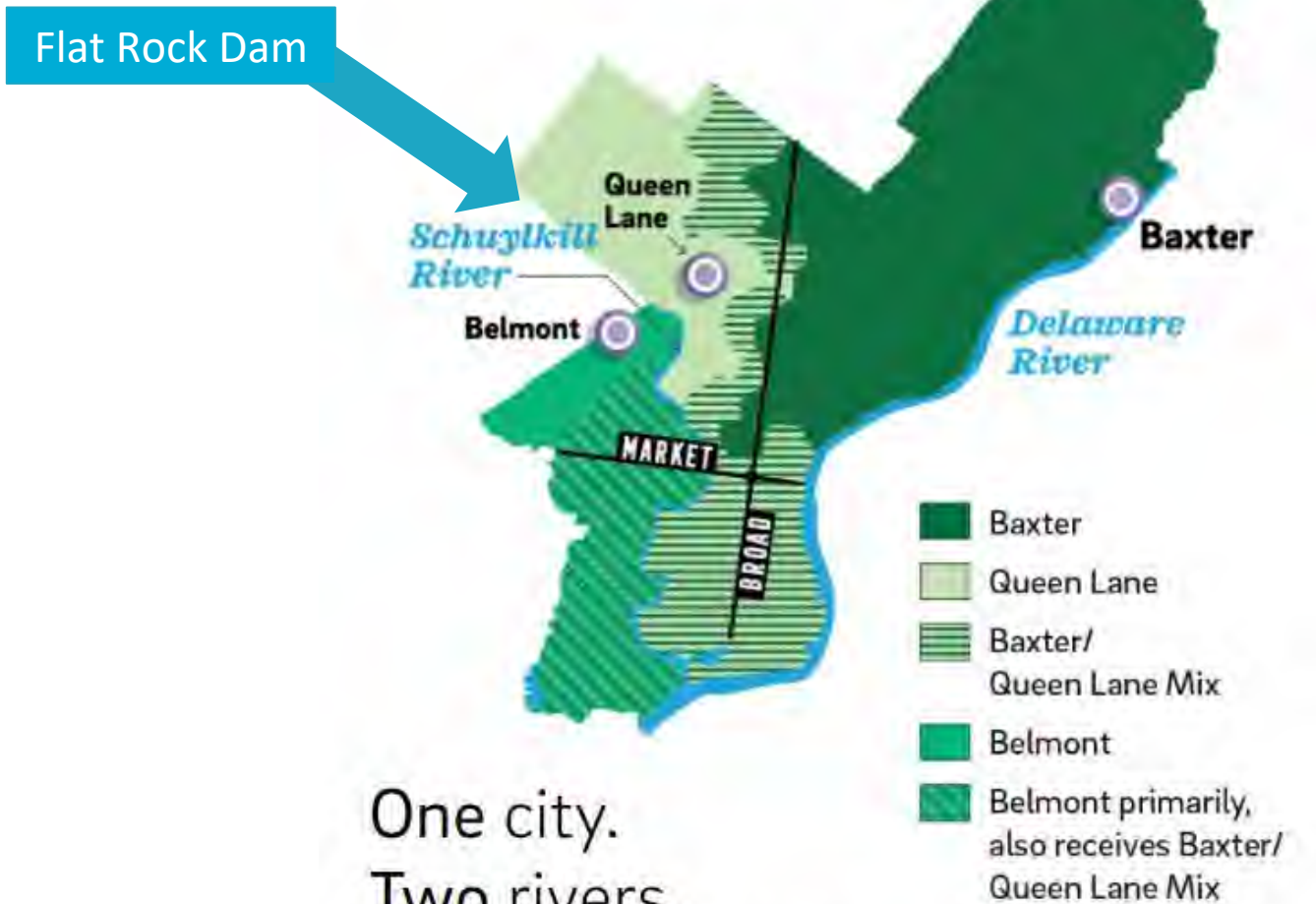
Algal bloom during drought conditions in 1999
(Upstream view at Lock Street)



Floating mats of benthic algae at Lock Street bridge
(2006)

Water Quality Concerns -

Downstream Drinking Water Intakes



One city.
Two rivers.
Three treatment plants.

Water Quality Concerns - *Flow Conditions*

- **Present conditions:**
 - Spring flow ranges from 3 – 5 cfs
 - Summer flow ranges from 1 – 3 cfs
 - Average velocity of 0.03 ft/s
- **Post-construction conditions:**
 - Flow ranges between 50 – 110 cfs
 - Average velocity between 0.3 – 0.5 ft/s



2011 summer flows over Lock Street (~1 cfs)

Water Quality Concerns - *Improvement Benefits*

Water Quality & Source Water Protection

- Flow diversion will:
 - Increase velocities
 - Decrease hydraulic residence time
 - Improve dissolved oxygen concentrations
 - Improve biological health of fisheries and aquatic organisms (mussels)
 - Reduce potential of harmful algal blooms



Reintroduce Freshwater Mussels



3. Construction Timeline & Community Impact

Project Timeline

- Design Drawings Completed – Winter 2020
 - Bidding – Winter 2021
 - Contract Awarded to A.P. Construction Inc. for \$16,301,250.00
 - Notice to Proceed – March 2022

 - Project Construction Period:
 - Estimated 900 calendar days of construction
 - March 2022 to September 2024
-

Gatehouse



March 2022 - Start of Work - Gatehouse



March 2022 - Start of Work – Upstream of Gatehouse



April 2022 - Start of Work – Gatehouse Downstream



May 2022 - Start of Work – Gatehouse Downstream



May 2022 - Start of Work – Site Clearing



May 2022

- Start of Work – Accessway Clearing One road in and out



Cofferdams



June 2022

- Install Upstream Channel Cofferdam



July 2022

- Install Upstream Channel Cofferdam



July 2022

- Install Upstream and River Cofferddam at Weir



August 2022- Install Upstream Channel Cofferdam



August 2022- Install Upstream Channel Cofferdam



September 2022 - Install River Cofferddam at Weir



September 2022 - Dewatering and Excavation, Turtle and Fish removal



September 2022 - Bedrock Excavation for Weir



September 2022 - Bedrock Excavation for Weir



October 2022 - Installation of Post-tensioned Rock Anchors



October 2022 - Excavation and Anchors at Bulkhead Wall and Canal Intake



November 2022 - Beginning of Rebar and Formwork Installation, Impact or Storm Events



Weir

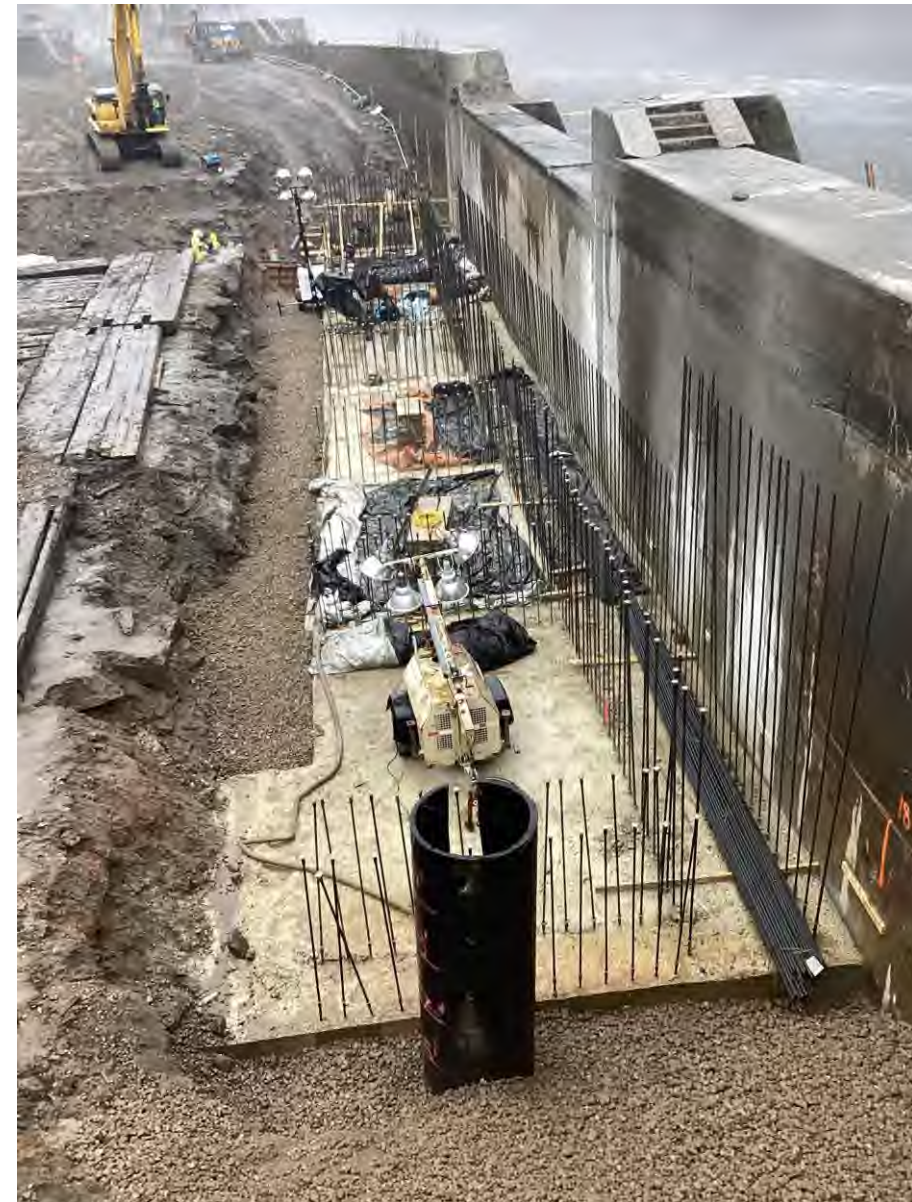


November 2022 - First Concrete Pour for Weir foundation behind Existing Weir



December 2022

- Constructing new concrete weir behind existing weir



December 2022 - Sign facing Schuylkill River Trail



January 2023 - Continuing Weir Concrete Work



Canal Intake



February 2023 - Rebar, Formwork, and Concrete at Canal Intake Structure Foundation



February 2023 - Demolition of old concrete weir



February 2023 - Community Meeting



March 2023 - Constructing bulkhead wall sections



March 2023 - Rock preparation and anchor installation for weir



March 2023 - Constructing bulkhead wall sections



April 2023 - Demolition of old Dam portion wall for new wall cap



April 2023 - Concrete pour for canal channel intake structure



May 2023 - Impact of Storm Events on in river work



June 2023 - Rebar, Formwork, and Concrete work for Weir



June 2023 - Rebar, Formwork, and Concrete work for Weir



June – July 2023 - Rebar, Formwork, and Concrete for Weir



July 2023 - Rebar, Formwork, and Concrete work on Canal Channel Foundations



July 2023 - Rebar, and Formwork Installation for Canal Intake



August 2023 - Rebar, Formwork, and Concrete work on Weir



August 2023 - Rebar, Formwork, and Concrete work on Canal Intake Structure, Gate Thimble Installation



September 2023 - Concrete pours at Sluiceway and Weir



September 2023 - Weir, Sluiceway, and Canal Intake Work Continues



Community Impact

- Schuylkill River Trail Closure Required
– September 2023 to January 2024



September 2023 - Schuylkill River Trail Closure Signs



September 2023 - Installation of Shoring for Bulkhead Wall Excavation



October 2023 - Shoring and Tieback Anchor Installation



October 2023 - Excavation, Shoring and Tieback Anchor Installation



November 2023

- **Upcoming Work Progress**
 - **Finish shoring Installation and Excavation**
 - **Install and Test Post-tensioned Rock Anchors in bulkhead wall footings**
 - **Bulkhead Wall Concrete foundations**

Community Impact

- Expected Project Completion:
 - September 2024

May 2022

Historic Gatehouse

Weir



September 2023



Historic Gatehouse

Weir

Completed

Historic Gatehouse

Weir



Flat Rock Dam — Manayunk Canal Betterment Project

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Project Updates: water.phila.gov/flat-rock

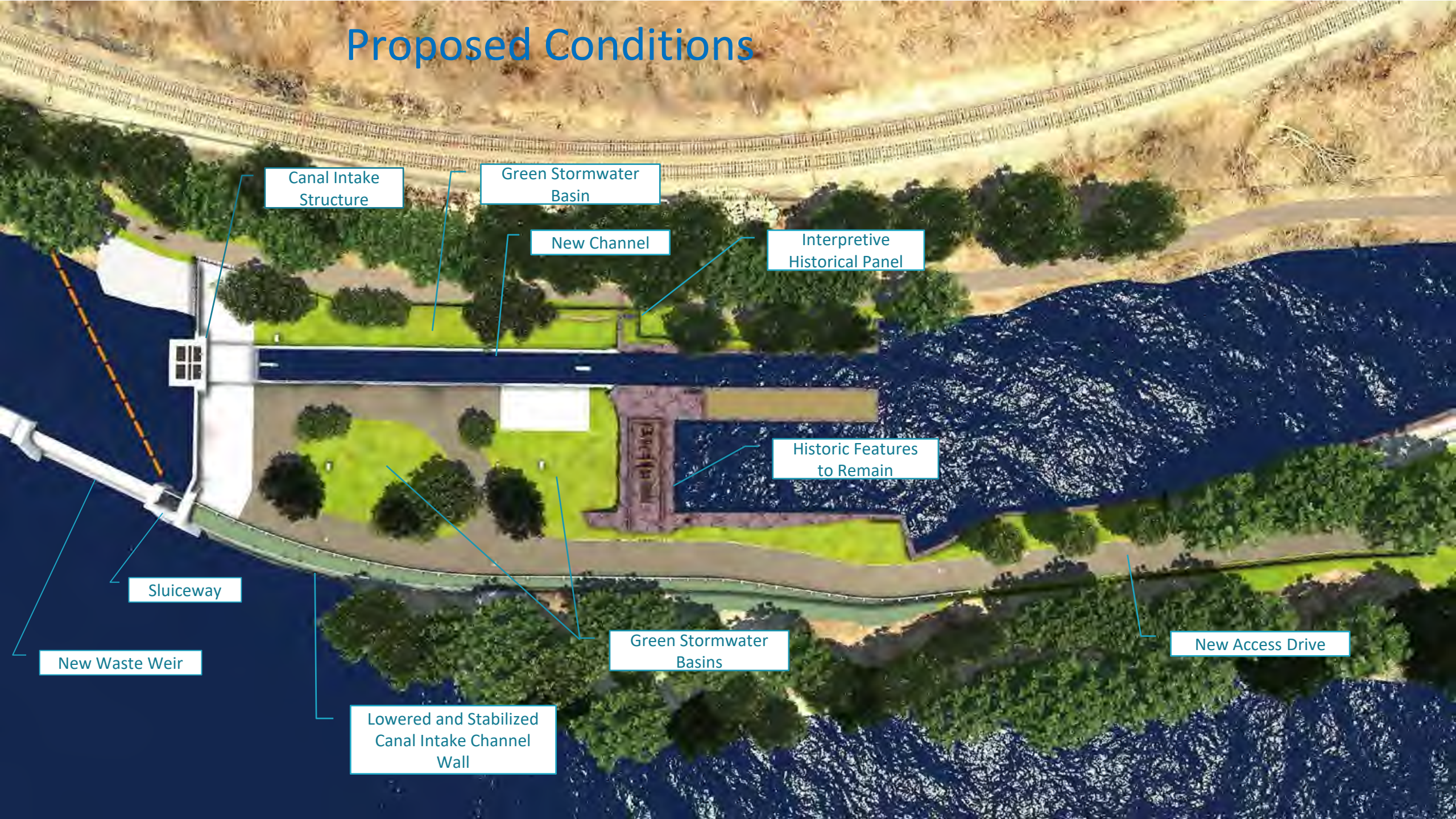
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Proposed Conditions



Canal Intake Structure

Green Stormwater Basin

New Channel

Interpretive Historical Panel

Historic Features to Remain

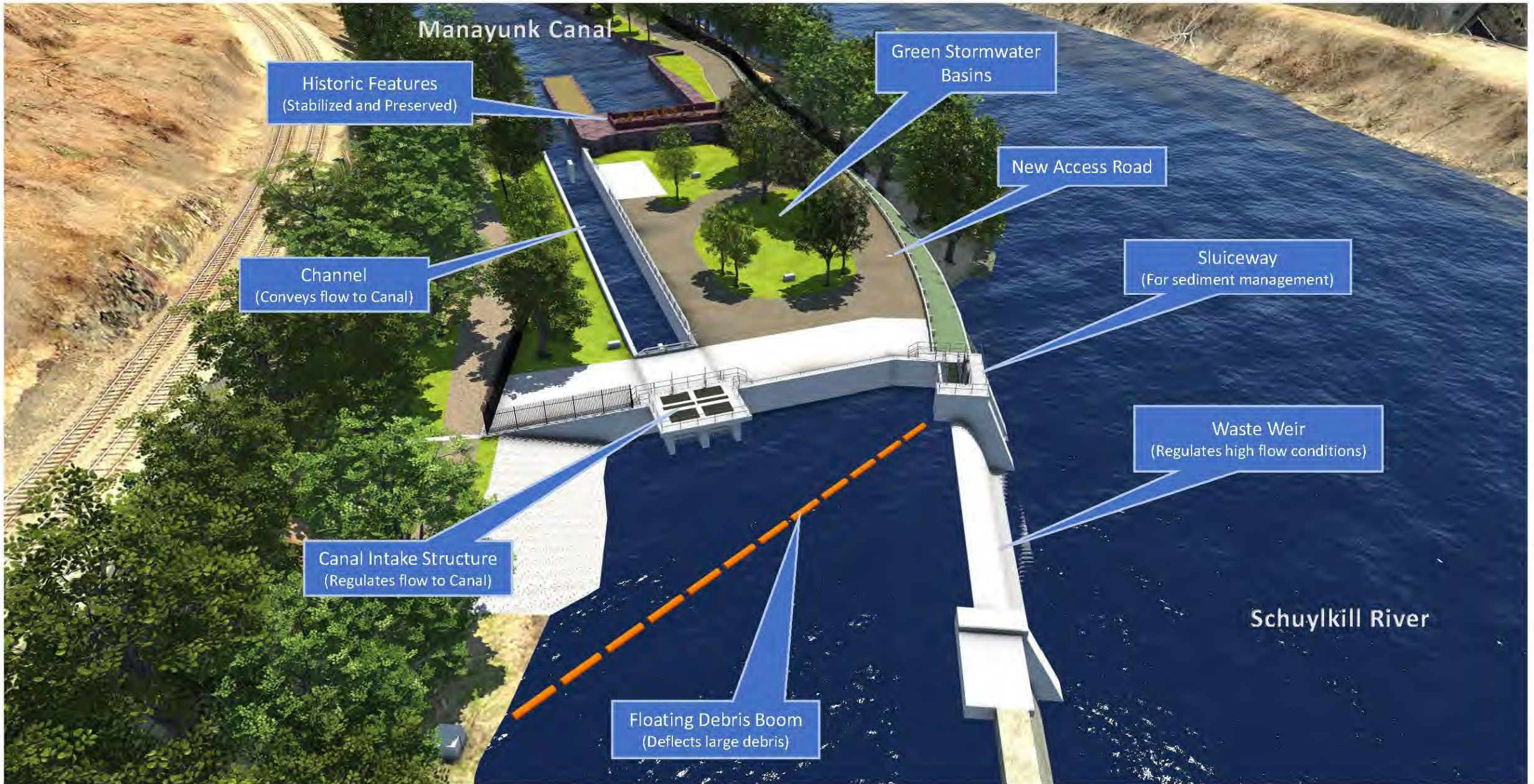
Sluiceway

New Waste Weir

Green Stormwater Basins

New Access Drive

Lowered and Stabilized Canal Intake Channel Wall



Manayunk Canal

Historic Features
(Stabilized and Preserved)

Channel
(Conveys flow to Canal)

Canal Intake Structure
(Regulates flow to Canal)

Floating Debris Boom
(Deflects large debris)

Green Stormwater
Basins

New Access Road

Sluiceway
(For sediment management)

Waste Weir
(Regulates high flow conditions)

Schuylkill River

December 2023 – September 2024

- **Upcoming Work Progress**
 - **Complete Bulkhead Wall**
 - **Remove Upstream Channel Cofferdam**
 - **Complete Canal Channel**

Thank you!

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Project page for updates: water.phila.gov/flat-rock



Flat Rock Dam

Overview: to inform the community about the Flat Rock Dam Betterment Project, share best contact information, and answer questions

Project Stakeholders / Partners:

- Philadelphia Parks and Recreation
- Army Corps Engineers
- PA DEP
- PA Historical Museum Commission (PHMC)
- Manayunk Development Corporation
- National Marine Fisheries Service
- Fish and Wildlife
- Art Commission
- PENNVEST

Flat Rock Dam

References:

- Ramboll, O'Brien & Gere Engineers, Inc.: Drone Photos
- Ian McKane, PWD: Photos
- Tom McIntyre, JBC Associates as PWD Inspector: Photos