NYC DDC Department of Design and Construction

NYSSPE – April 21, 2021

"LEADING NYC ESSENTIAL INFRASTRUCTURE WORK."

Horizontal Directional Drilling (HDD)
New 20" Sub-Aqueous Water Mains To City Island

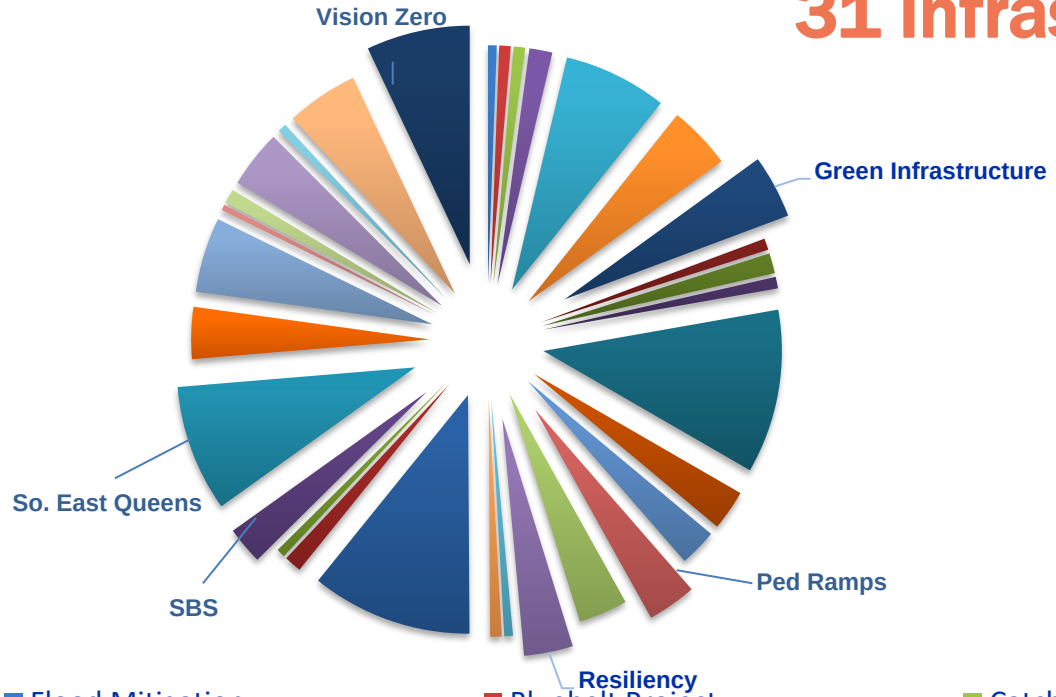
Presented by:
Eric C Macfarlane, P.E., M.ASCE, ENV-SP, NAC
Deputy Commissioner, Infrastructure Division

Ali Mallick, P.E.
Assistant Commissioner

NYCDDC 28 SPONSOR AGENCIES

DDC PROJECTS

31 Infrastructure Project Types



Estimated Construction Value

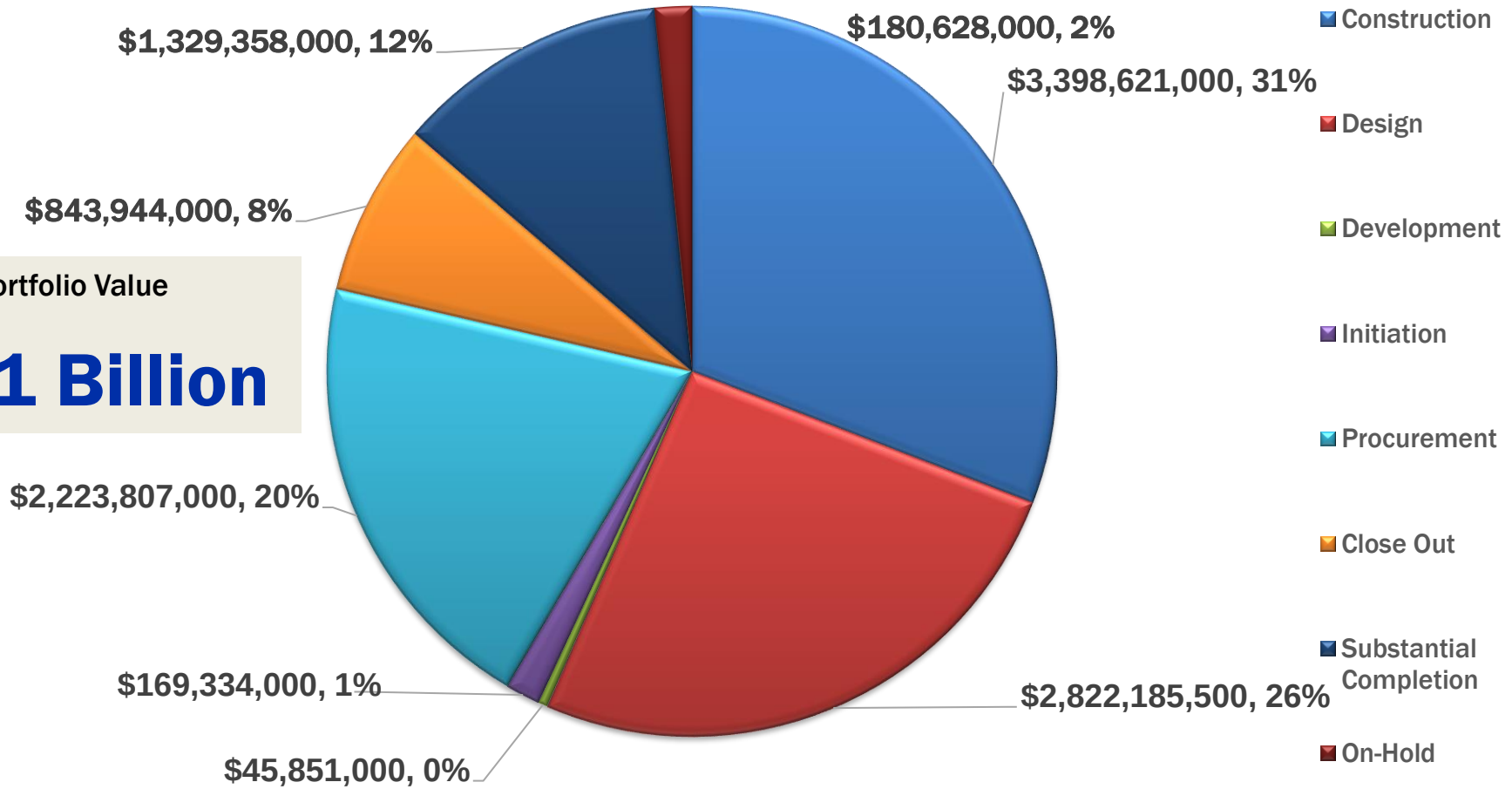
$11 Billion

- Flood Mitigation
- Bluebelt Project
- Catch Basins
- Combined Sewers
- Distribution Water Main
- Emergency Repair
- Green Infrastructure
- Infra Development
- Intersection Improvement
- New Sanitary Sewers
- New Storm Sewers
- Pedestrian Ramp Rehab
- Pedestrian Bridge
- Pedestrian Ramps
- Plazas
- Resiliency
- Resurfacing
- Retaining Wall
- Roadway Reconstruction
- Sanitary Sewer Reconstruction
- Security
- Select Bus Service Imprvovement
- SEQ Storm Sewer Program
- Sewer Rehabilitation
- Sidewalk Maintenance
- Special Project
- Step Street
- Streetscape
- Trench Restoration
- Trunk Water Main
- Vision Zero

Infrastructure Portfolio

Phase	Value	# Projects
Construction	$3,398,621,000	112
Design	$2,822,185,500	114
Development	$45,851,000	13
Initiation	$169,334,000	17
Procurement	$2,223,807,000	34
Close Out	$843,944,000	108
Substantial Completion	$1,329,358,000	113
On-Hold	$180,628,000	21
Total	$11,013,728,500	532

Infrastructure Portfolio Current Value



Total Portfolio Value

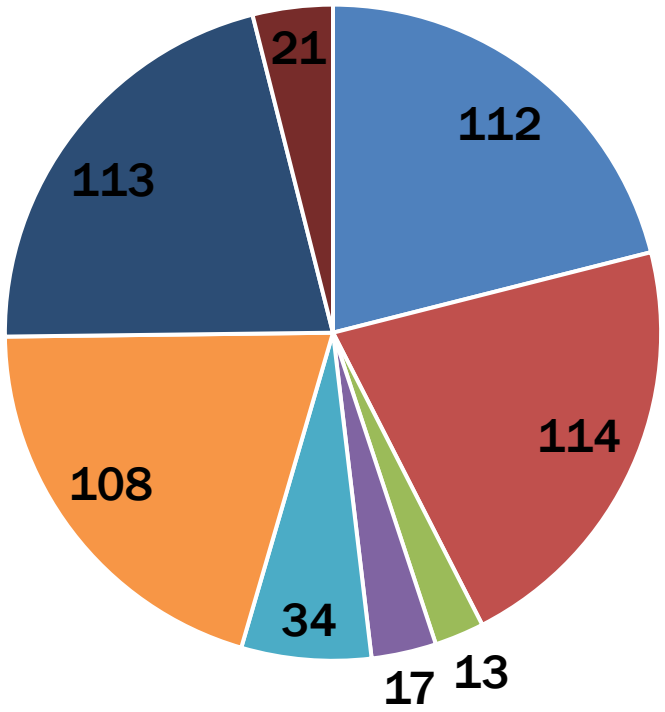
$11 Billion

* Data as of 2/2/2021

Infrastructure Projects by Phase

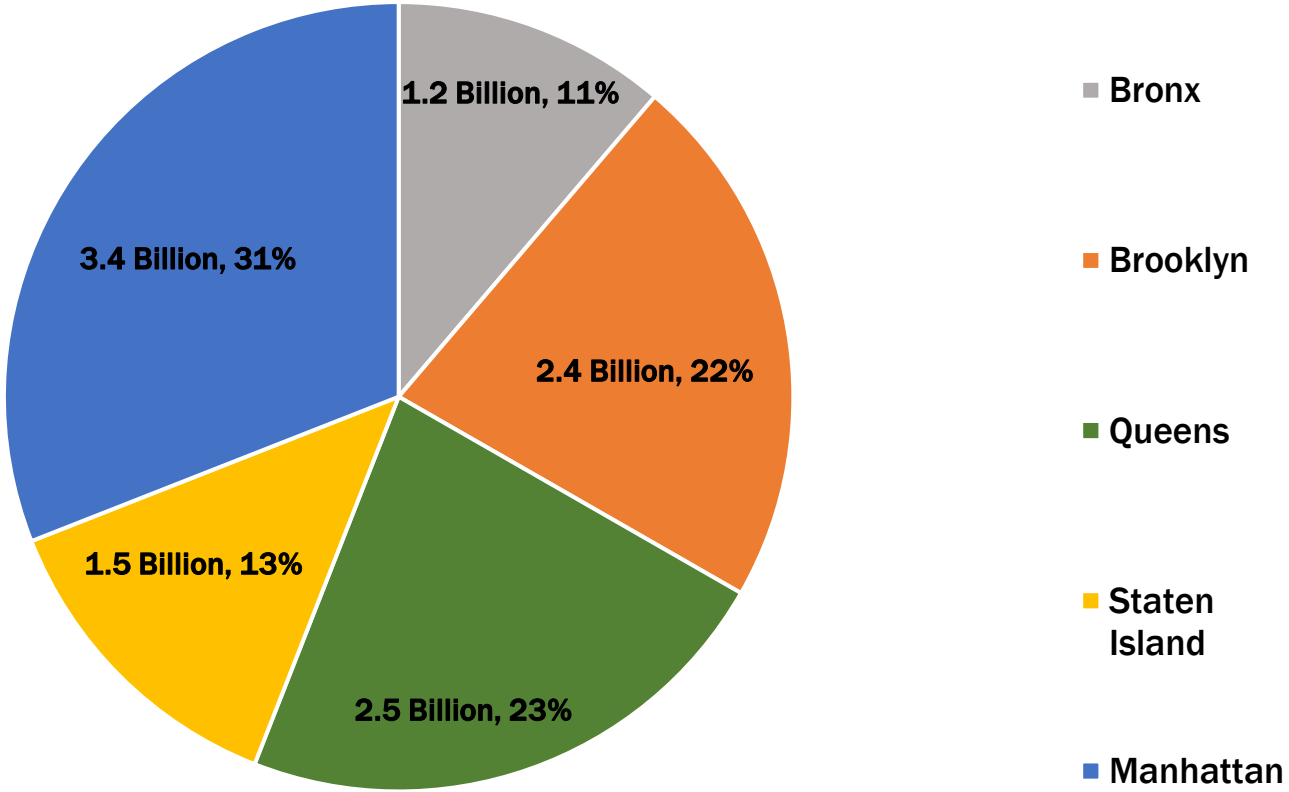
Total Portfolio Number of Projects

532



* Data as of 2/2/2021

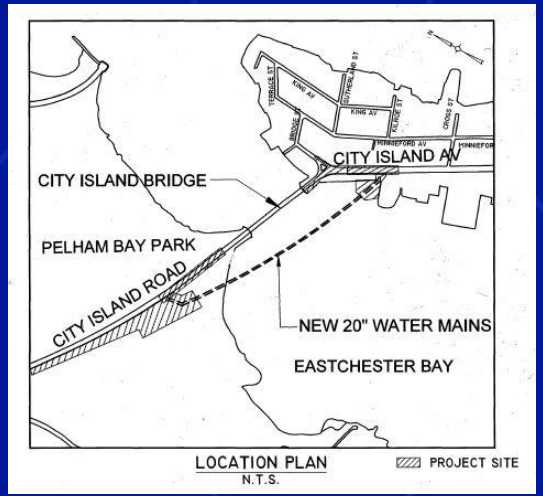
Infrastructure Projects Values by Borough



* Data as of 2/2/2021

Department of
Design and Construction

New 20” Sub-Aqueous Water Main To City Island
Project ID#: HED564



Presented by
Eric Macfarlane, P.E. – Deputy Commissioner
Ali Mallick, P.E. – Assistant Commissioner

Presentation Agenda

- ❑ I. Project Overview
- ❑ II. Design Consideration
- ❑ III. Construction Consideration
- ❑ IV. Construction Phase Progress Update
- ❑ V. Open Discussion

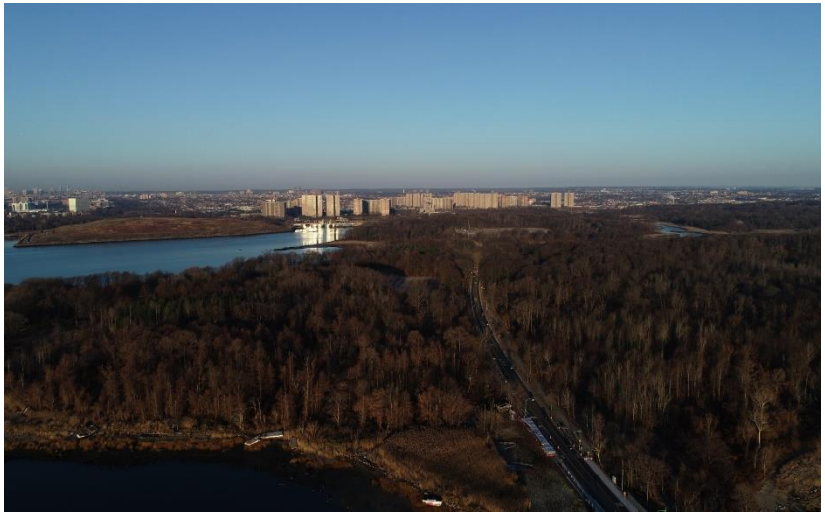
I. Project Overview

Description of Project

This DEP sponsored project is intended to replace the 100-year-old, unlined cast iron water main pipes, and improve the water distribution system of City Island, Bronx as well as provide new storm sewers to improve drainage in the area. This work includes:

- Horizontal Directional Drilling (HDD) of two 2,000-ft-long subaqueous water tunnels under Eastchester Bay from Pelham Bay Park to City Island. Install 20” ductile iron water main pipe inside 32” drilled steel sleeve pipes.
- Replacement of old unlined cast iron water main pipes with new lined ductile iron water main pipes, connecting to the two new subaqueous water tunnels.
- Installation of new storm sewer outfall and storm sewer connections on City Island
- Removal of existing temporary steel watermain on the City Island Bridge

II. Design Consideration

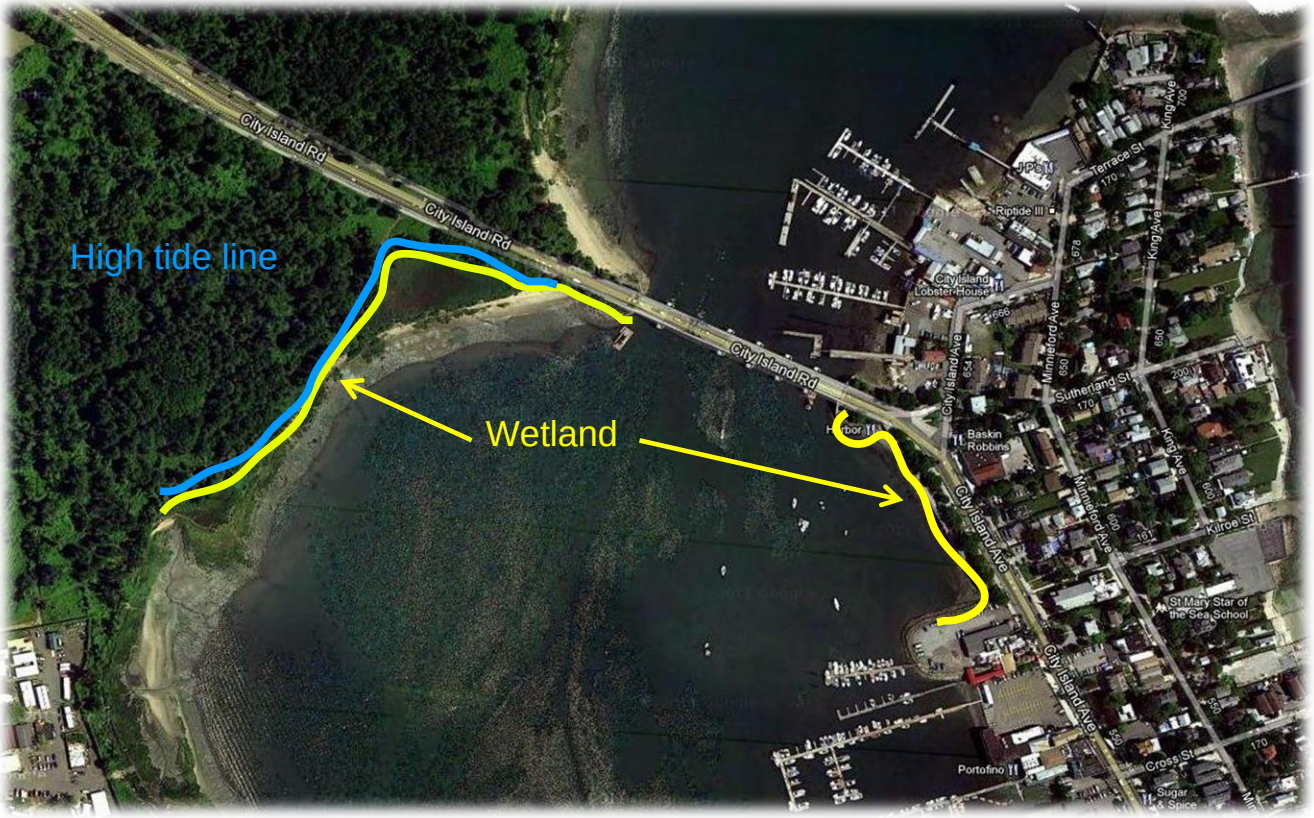


looking west toward Bronx Pelham Bay Park

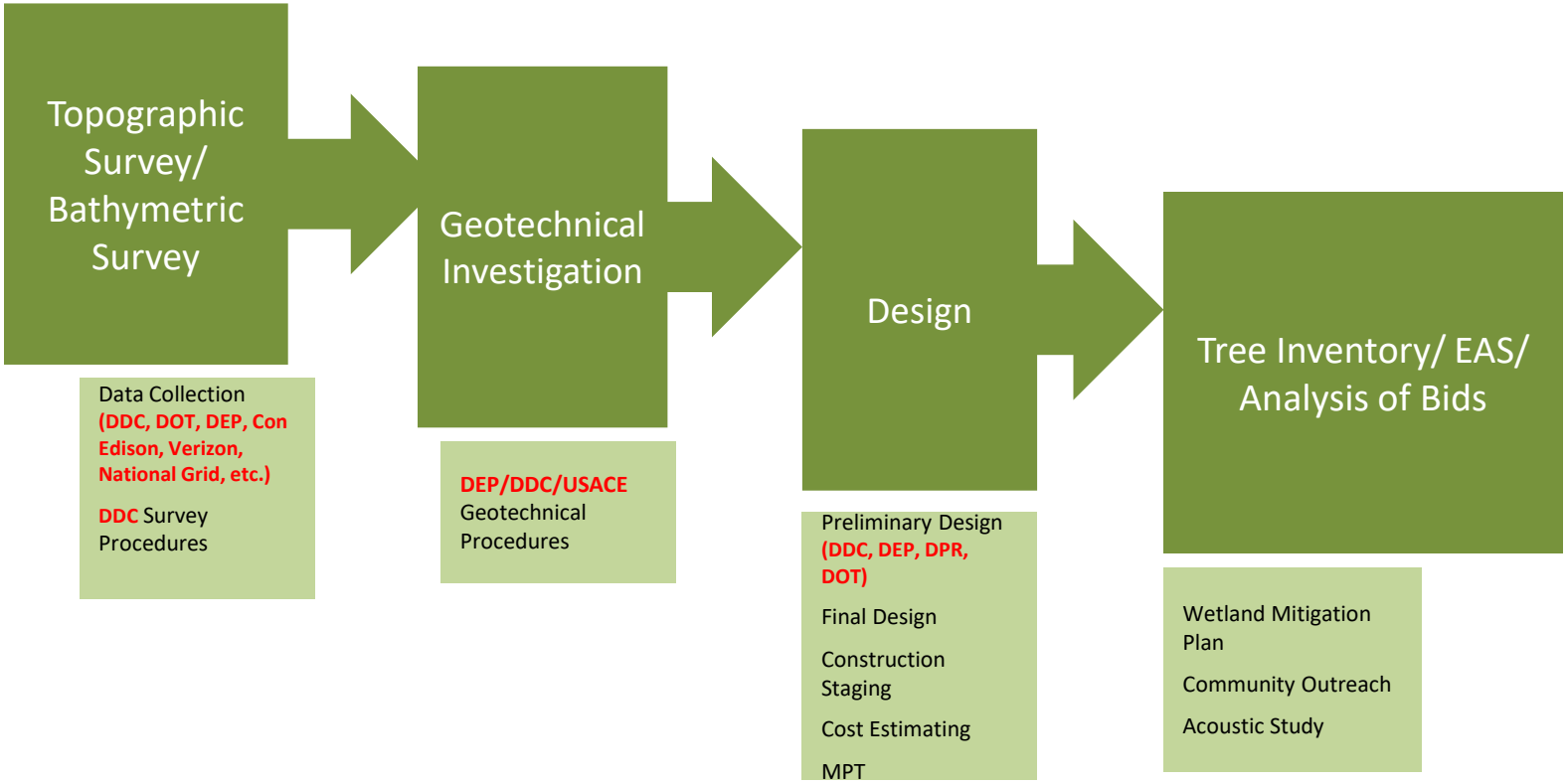
City Island Catherine Scott Promenade

City Island Bridge Replacement Project

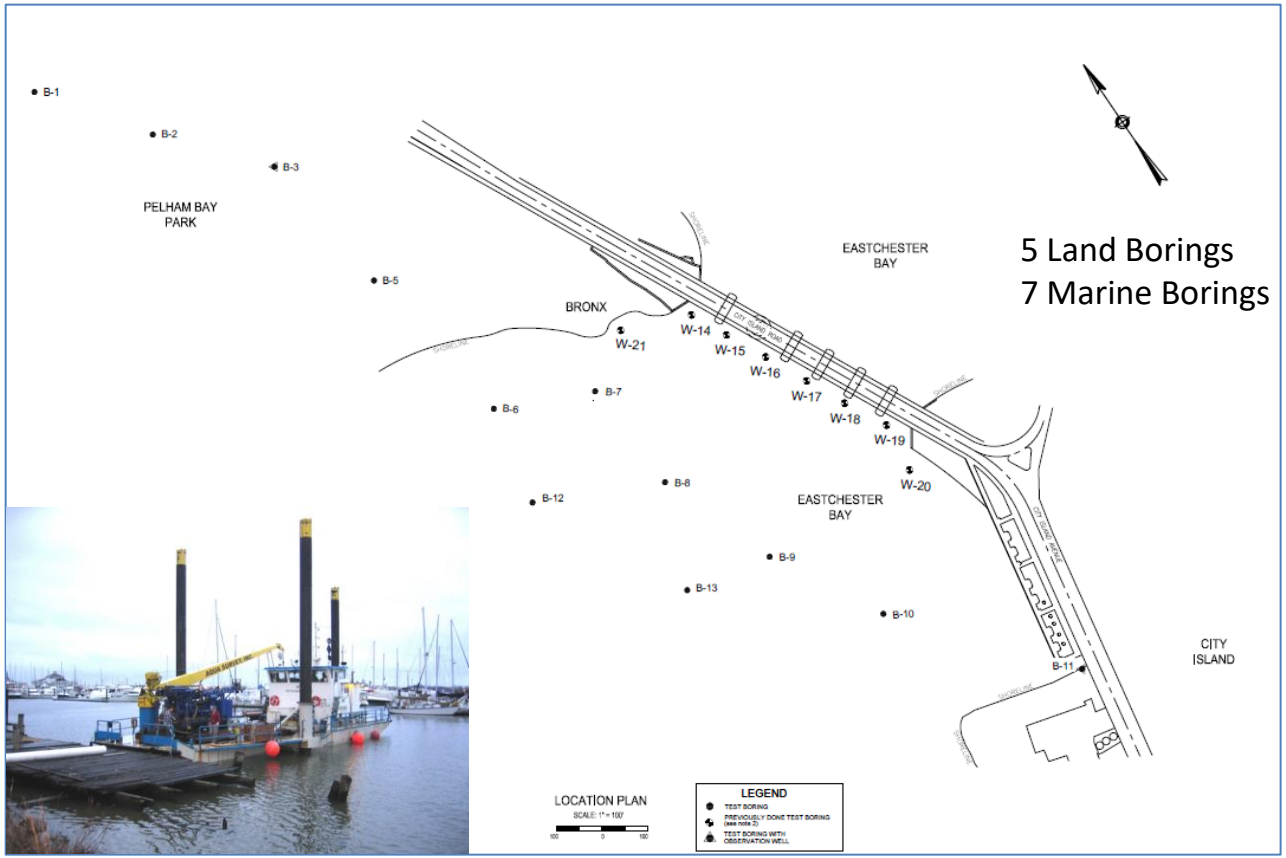
Overall Site Conditions



Tasks


Topographic Survey/ Bathymetric Survey
Data Collection (DDC, DOT, DEP, Con Edison, Verizon, National Grid, etc.)
DDC Survey Procedures
Geotechnical Investigation
DEP/DDC/USACE Geotechnical Procedures
Design
Preliminary Design (DDC, DEP, DPR, DOT)
Final Design
Construction Staging
Cost Estimating
MPT
Tree Inventory/ EAS/ Analysis of Bids
Wetland Mitigation Plan
Community Outreach
Acoustic Study

Geotechnical Investigations



Proposed Alignment Alternatives

Investigated 6 possible alternatives:

- 4 HDD Options with variations
- 1 Microtunnel Option
- 1 Horizontal Rock Boring (HRB) Option

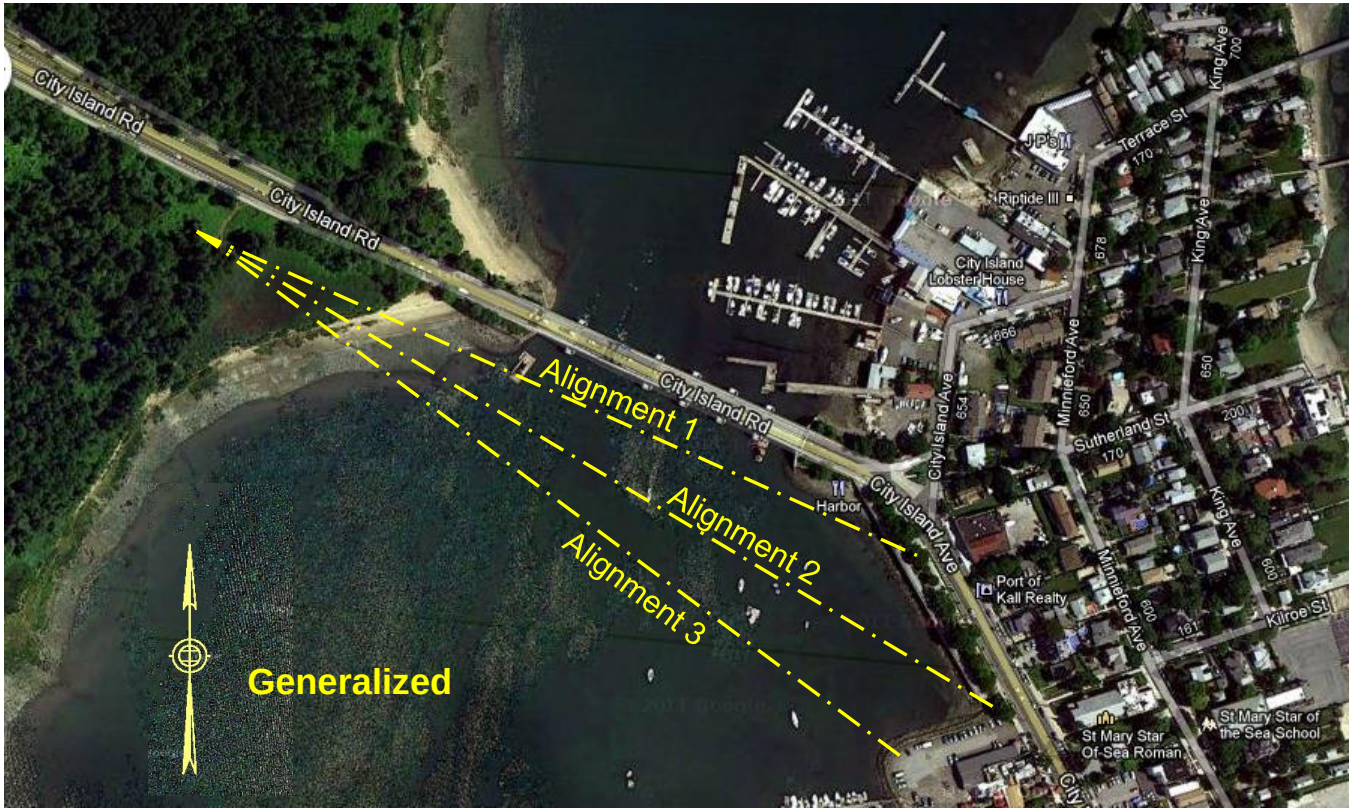
Trenchless Technology Alternatives

Horizontal Rock Boring

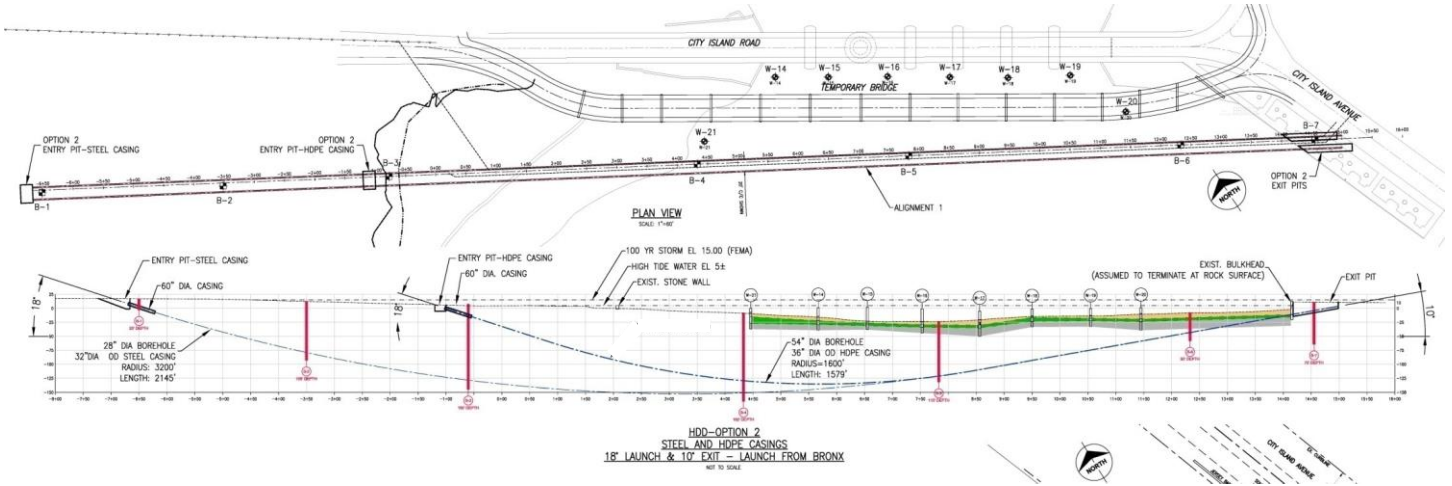
Horizontal Directional Drilling

Microtunneling

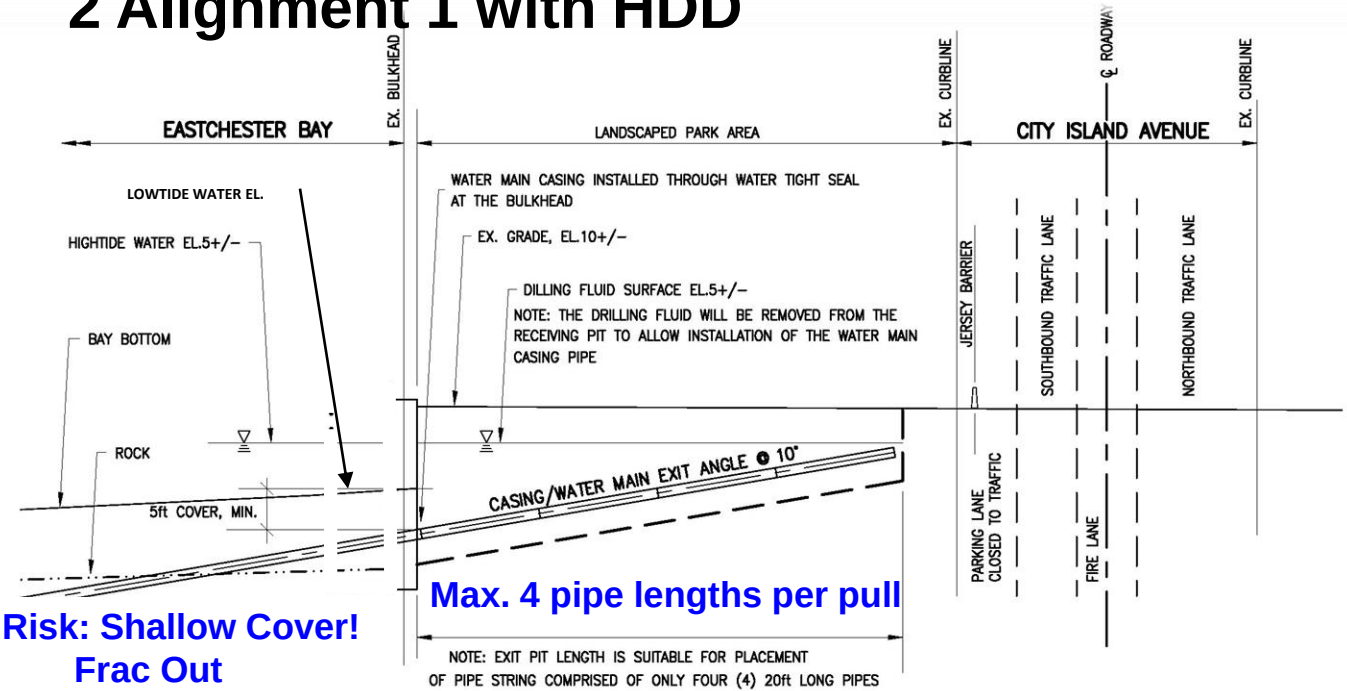
Proposed Alignment Alternatives



Proposed Alignment Alternatives – Option 2 Alignment 1 with HDD



Proposed Alignment Alternatives – Option 2 Alignment 1 with HDD



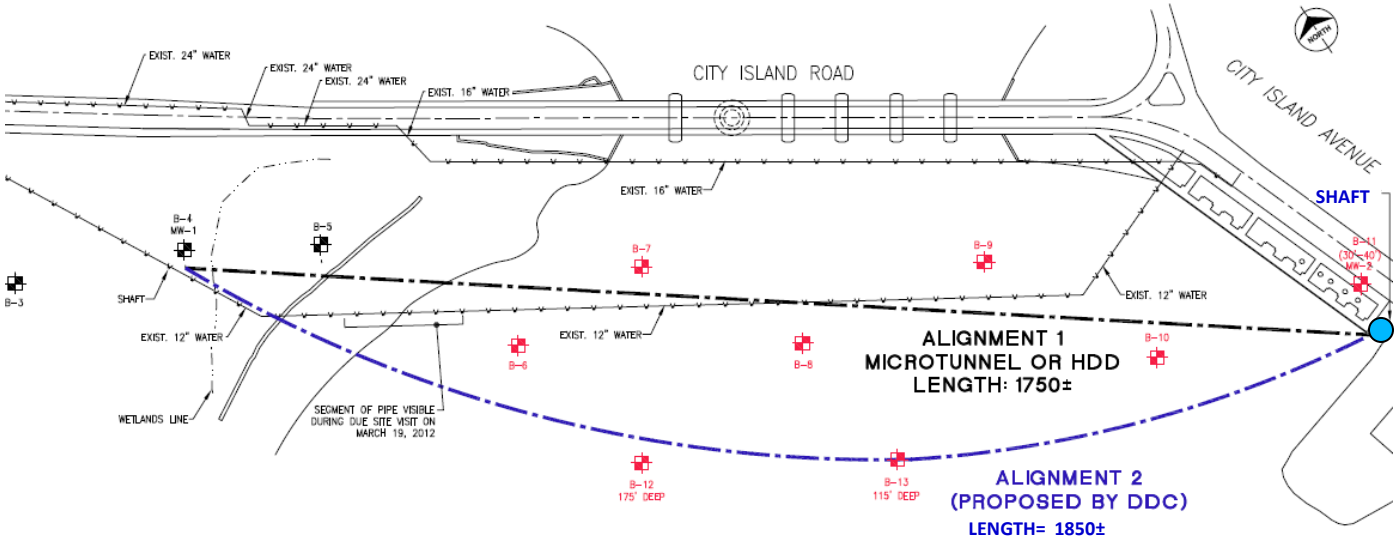
Max. 4 pipe lengths per pull

Risk: Shallow Cover!
Frac Out

Rock must be less than 20 KSI - no room for second drilling rig

Exit Pit – Detailed Plan View

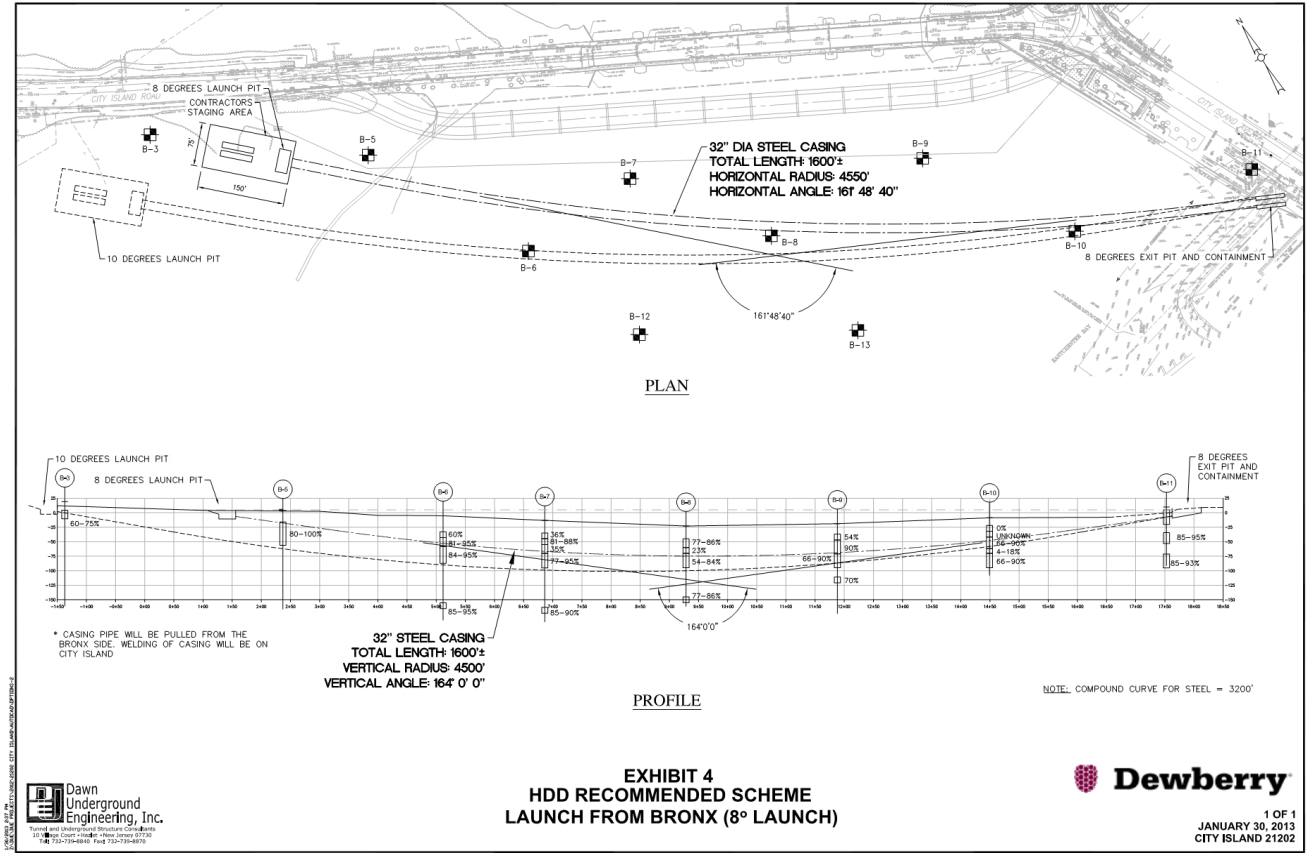
Pre- Final Design
HDD vs Microtunneling



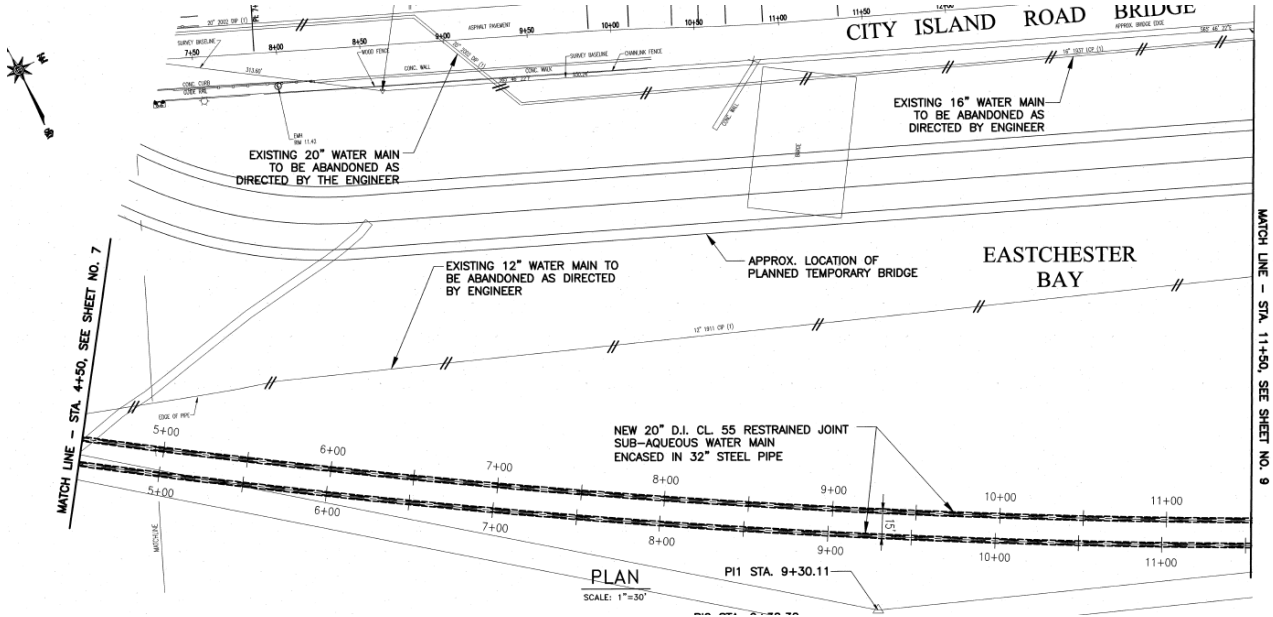
Plan View

B-12
175' DEEP

Final Design

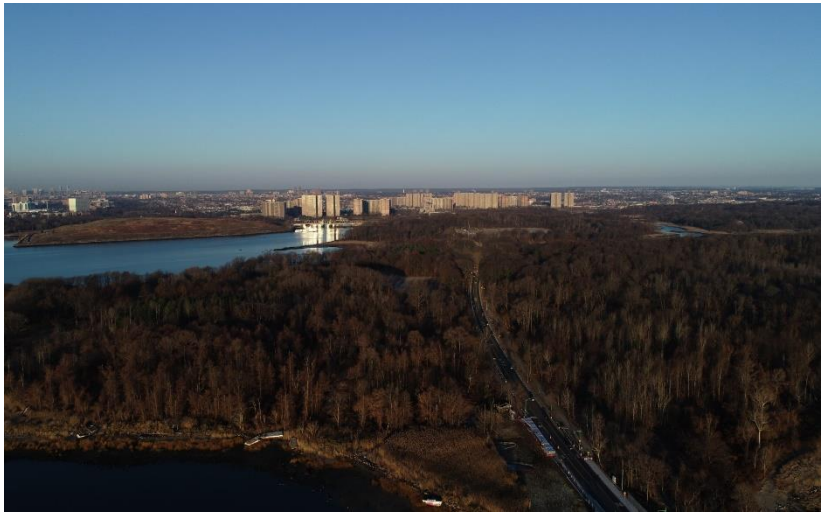


Challenges & Lessons Learned – Compound Curve & Separation Dist.



III. Construction Consideration

Project Limits



looking west toward Bronx Pelham Bay Park

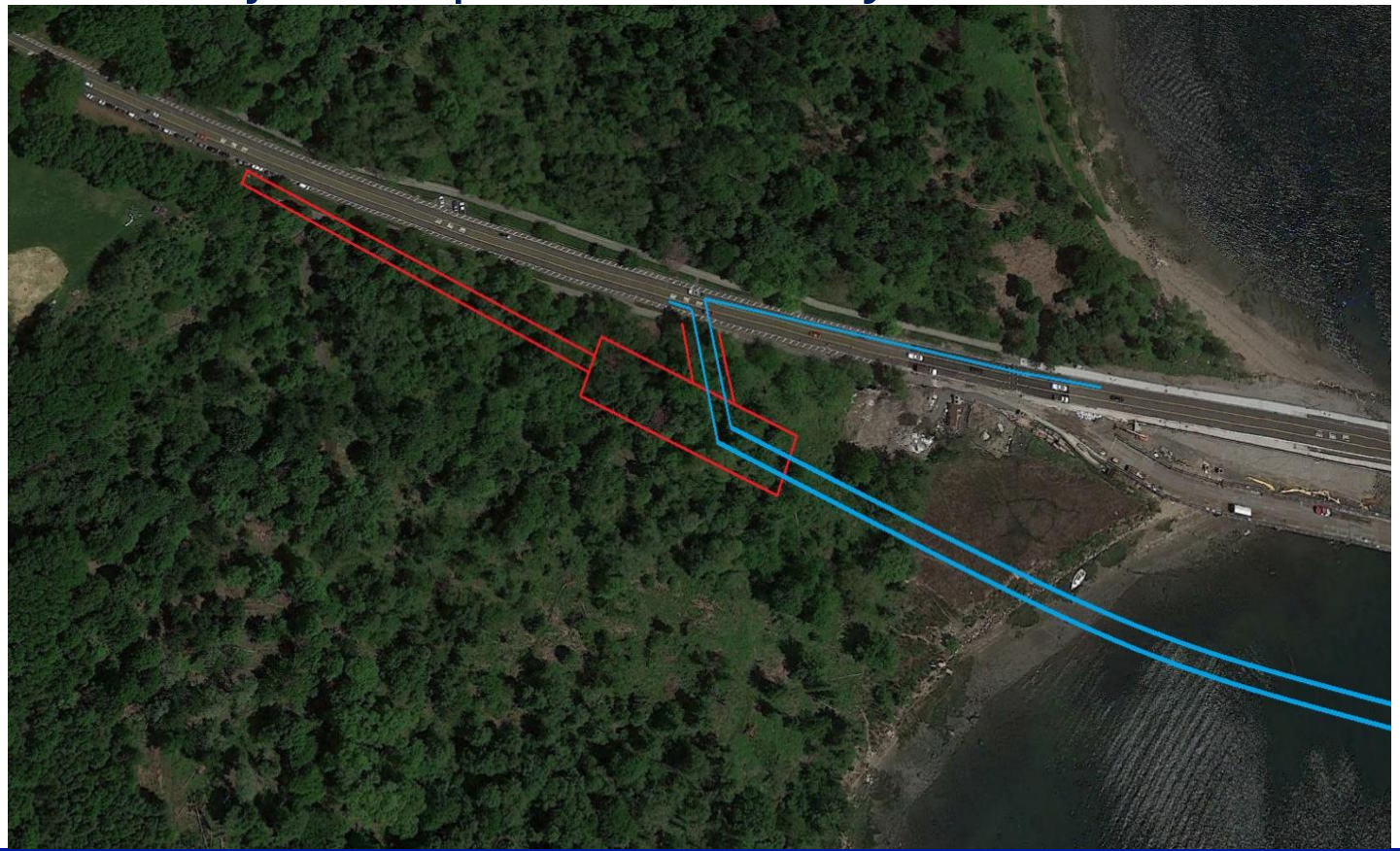
City Island Catherine Scott Promenade

Project Map – Pelham Bay Park Location

Legend

Blue-Water Lines

Red-Contractor Staging / Laydown Area



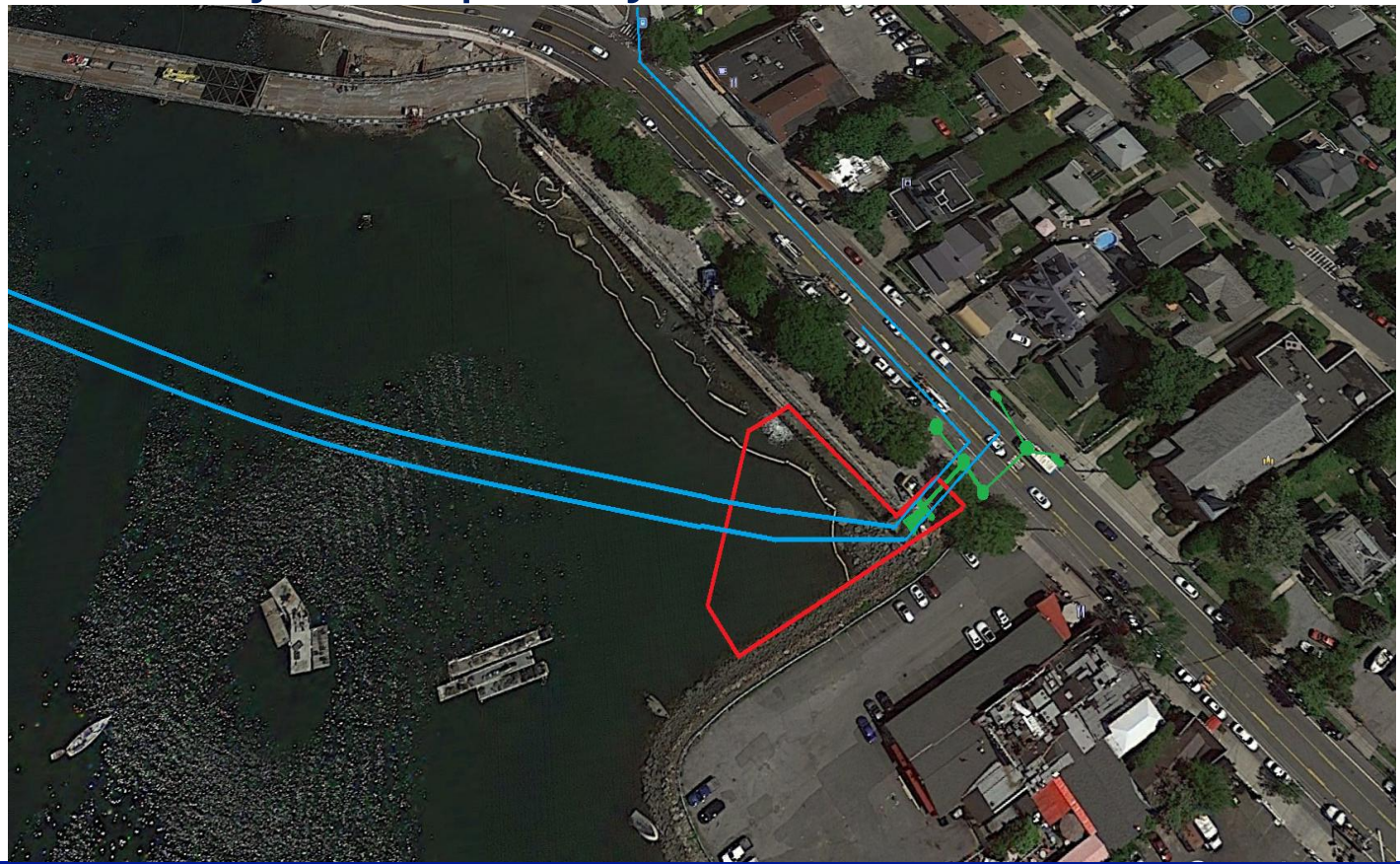
Project Map –City Island Location

Legend

Blue-Water Lines

Green-Sewer & Outfall

Red-Contractor Laydown area



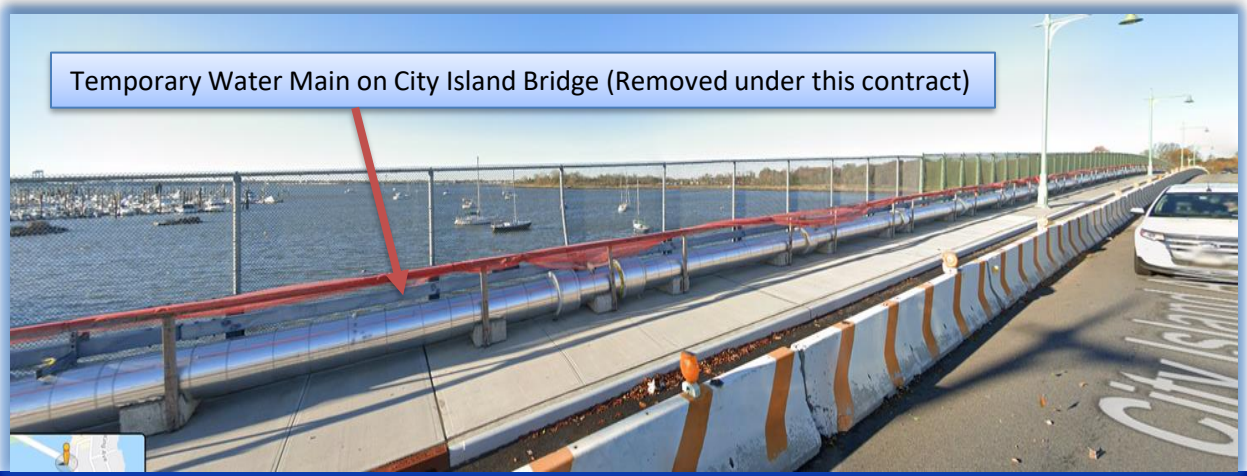
Project Description and Objectives

HED564 - DEP sponsored project:

- To replace existing 100 yr. old Cast Iron Water Main
- Improve existing water distribution system

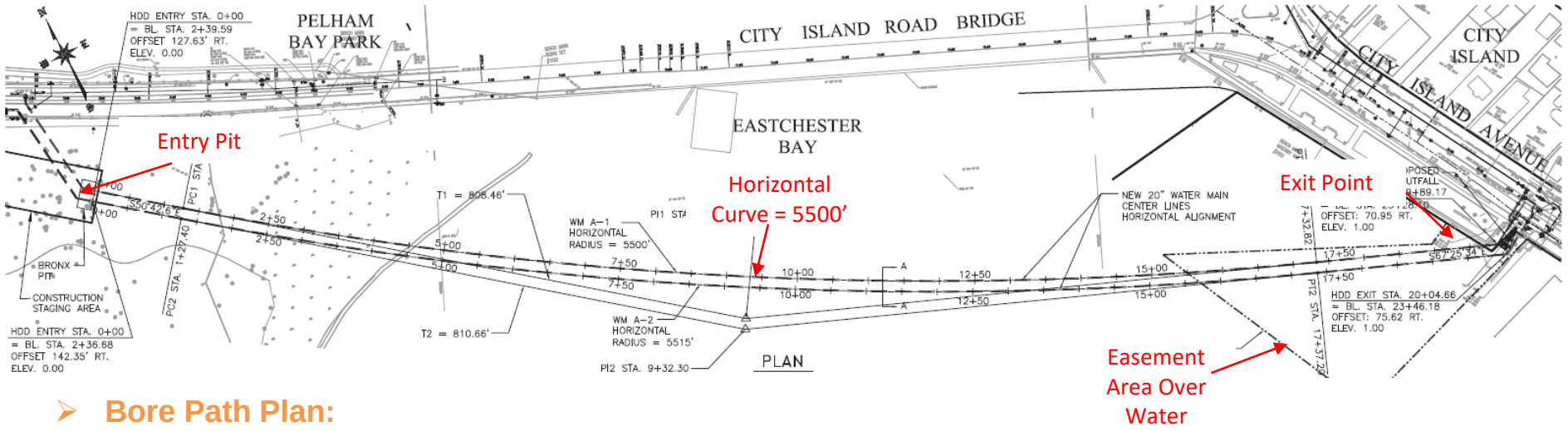
Project Features:

- Install two 20-inch Sub-Aqueous Water Mains across the Eastchester Bay by **Trenchless construction method: Horizontal Directional Drilling (HDD).**
- New Water Main length = 2,000 Linear feet

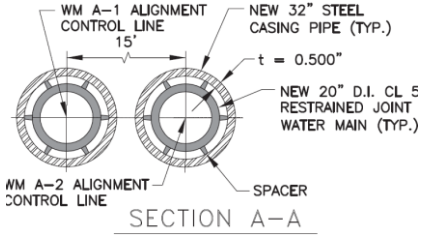


Existing Cast Iron Water Main on Bayside

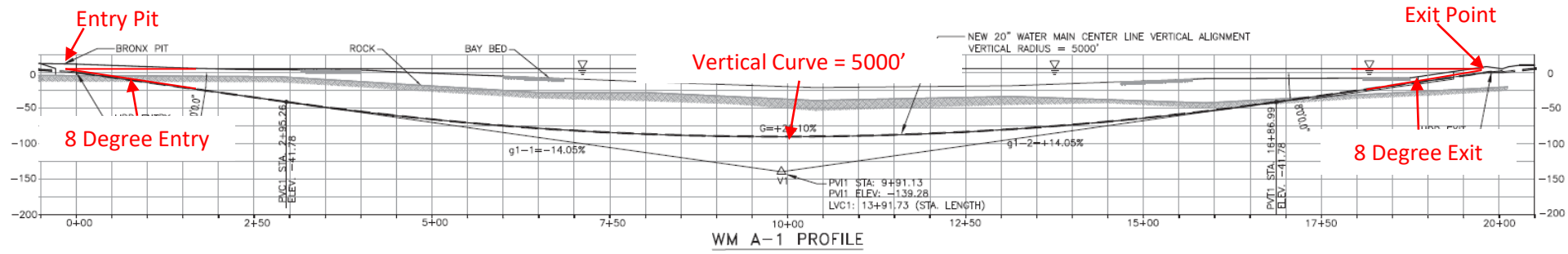
Design Consideration



- **Bore Path Plan:**
  - Two side by side water tunnels (~3,100 feet each) with 15-foot center line separation with 5,500-foot radius
  - Entry pit and HDD laydown restricted to Park side
  - Horizontal curve to avoids obstacles
  - Required significant HDD laydown area
  - Required easement area over water at exit site
  - Ductile iron pipe installed inside steel casing



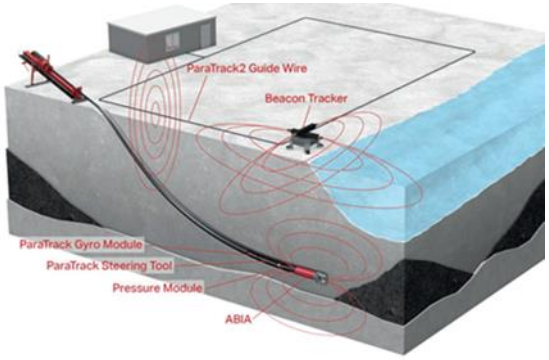
Design Drill Path



- **Designed Bore Path and Vertical Profile:**
  - 8 degree entry and exit – Near flat entry angle needed for steel pipe to minimize bend-over support for the steel pipe during installation
  - 5,000 foot vertical curve + 5,500 horizontal curve = compound curved profile
  - Bore profile predominantly in fractured Gneiss

Design Risk Mitigation

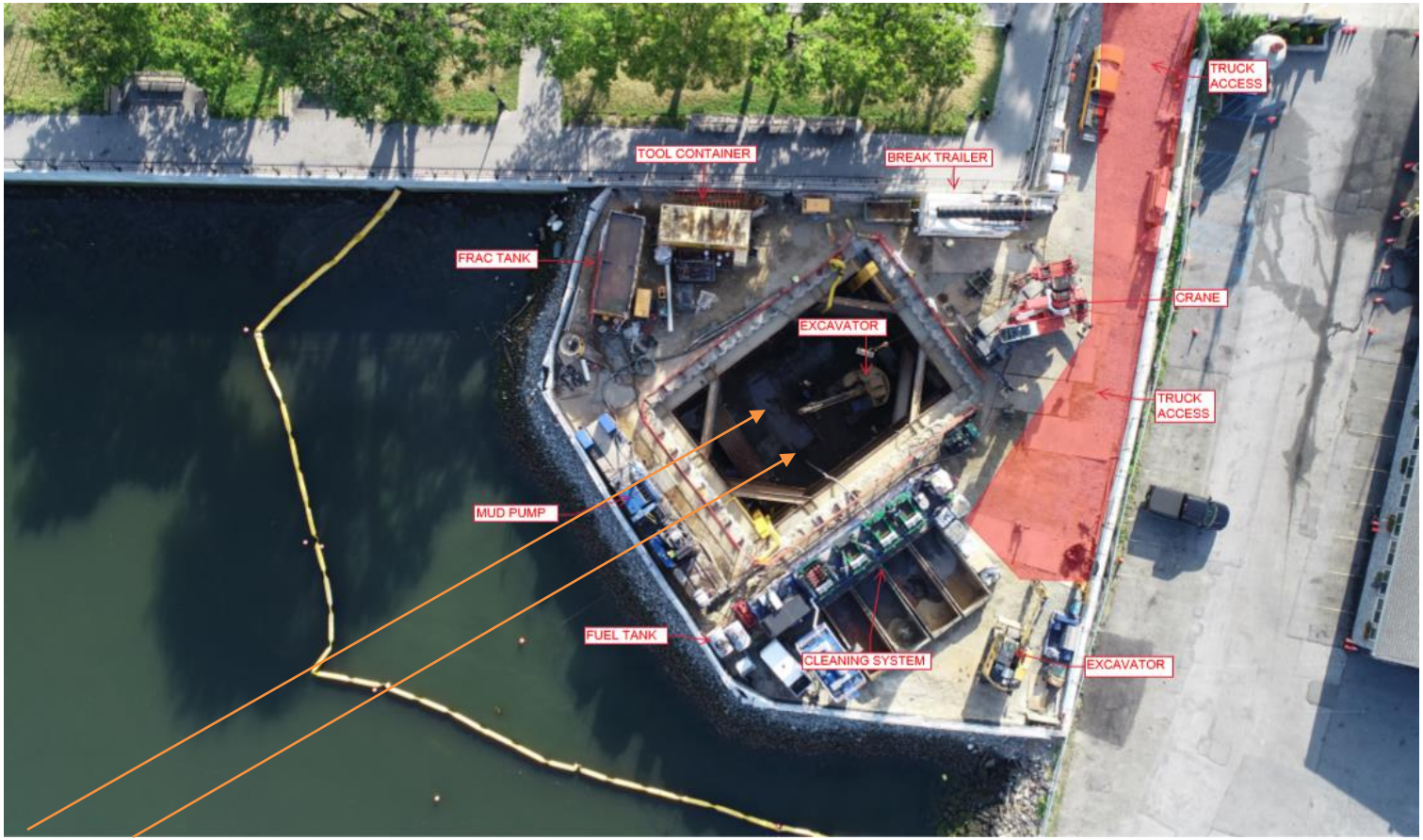
- **Primary Project Risks Identified:**
  - Need to identify and allocate laydown area for HDD assembly and pullback
  - Requirement for additional temporary workspace easements for efficient HDD operations
  - Eliminate compound curve to keep alignment straight with vertical curves only to increase project success
  - Eliminate contact grouting outside steel casing to mitigate health and safety risks
  - Design augmentation with land build-out to incorporate coffer dam and need to develop additional workspace on exit side
  - Line and grade control to develop parallel bore paths to exit site – Deploy Gyroscope tracking system




SEA SHORE


KOMATSU

“Punch Out” at City Island



Scope of Work

Installation of Water Main:

- Two 32” subaqueous water tunnels – Approx. 2,000 Linear Feet (LF) each
- 8”, 12”, 20” (in 32” drilled steel sleeve), and 24” mains – Totaling 6,255 LF
- Hydrants – 9 (6 replacement, 3 additional)

Installation of Storm Sewers:

- 12”, 18”, 24”, 36” mains – Totaling 125 LF
- Sewer Outfall On City Island - 1
- Manholes and Catch Basins – 4 each
- Roadway and sidewalk restoration – 1,350 Square Feet (SF) and 3,200 SF, respectively

Removal, Pruning and Installations of Trees:

- Trees for Removal – 252, Includes the Brotherhood Tree (arborist has certified as dead)
- Trees for Pruning – 45 under this contract - as Needed
- Trees for Planting - 135 under this contract, plus tree restitution through NYC Parks

- Tree removals are in accordance to the NYC Parks and supervised by a certified arborist.
- Restitution for tree removals will be funded by the NYC DEP to NYC Parks.
- Trees not slated for removal will be protected as per NYC Parks guidelines.

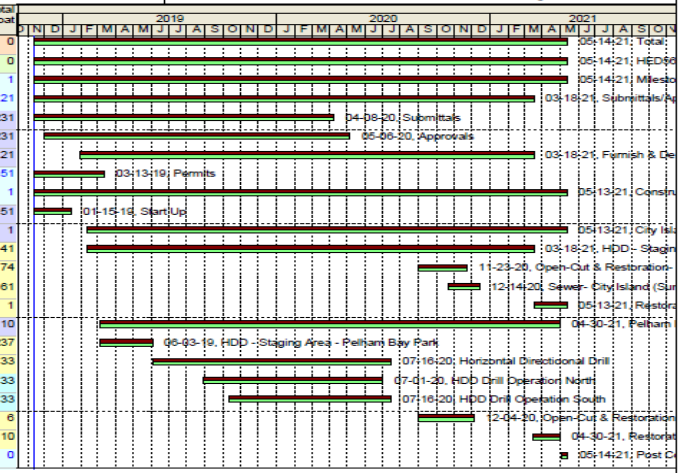
Project Data

a)	Notice to Proceed Date:	11/12/18
b)	Contract Duration:	915 CCDs
c)	Current Approved Contract Duration:	915 CCDs
d)	Anticipated Completion Date:	05/15/21
e)	Contract Time Elapsed to Date:	473 CCDs (03/01/2020)
f)	Percent of Time Elapsed:	51.69%
g)	Percentage of Actual Work Completed:	13.97%
h)	Contract Amount:	$26,294,396.50
i)	Registered Change Order Request:	$ .00
j)	Registered Overrun Request:	$ .00
k)	Current Registered Contract Amount:	$26,294,396.50
l)	Contractor:	Northeast Remsco

Baseline Schedule

HED564 20" WM to City Island BaseLN rev. 3 | *HED564 Summary WBS* | HED564-B3 | Page 1 of 1

Activity ID / Activity Name	Original Duration	Remaining Duration	Start	Finish	Total Float
Total	626	626	11-13-18	05-14-21	0
HED564 20" WM to City Island BaseLN rev. 3	626	626	11-13-18	05-14-21	0
Milestones	914	914	11-13-18	05-14-21	1
Submittals/Approvals/Procurement	585	585	11-13-18	03-18-21	21
Submittals	350	350	11-13-18	04-08-20	231
Approvals	360	360	11-29-18	05-06-20	231
Furnish & Deliver	535	535	01-29-19	03-18-21	21
Permits	81	81	11-13-18	03-13-19	151
Construction	625	625	11-13-18	05-13-21	1
Start Up	42	42	11-13-18	01-15-19	51
City Island	565	565	02-12-19	05-13-21	1
HDD - Staging Area & Cofferdam Construction - City Island	525	525	02-12-19	03-18-21	41
Open-Cut & Restoration- Water Main - City Island (Summer & Winter Embargo)	57	57	09-01-20	11-23-20	74
Sewer- City Island (Summer & Winter Embargo)	37	37	10-20-20	12-14-20	61
Restoration - City Island	40	40	03-19-21	05-13-21	1
Pelham Bay Park	541	541	03-06-19	04-30-21	10
HDD - Staging Area - Pelham Bay Park	63	63	03-06-19	06-03-19	237
Horizontal Directioonal Drill	221	221	06-04-19	07-16-20	33
HDD Drill Operation North	149	149	08-30-19	07-01-20	33
HDD Drill Operation South	130	130	10-11-19	07-16-20	33
Open-Cut & Restoration - Water Main - Pelham Bay Park (Summer & Winter Embargo)	64	64	09-01-20	12-04-20	6
Restoration - Pelham Bay Park	34	34	03-16-21	04-30-21	10
Post Construction Operation	10	10	05-03-21	05-14-21	0



Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary

NRC
HED564 20" WM to City Island BaseLN rev. 3
HED564 Summary WBS

Project Start Date: 11-13-18
Project Finish Date: 05-14-21
Data Date:11-13-18

Prepared by Avila Consultants, Inc.

Construction Sequence

PRELIMINARY / Summer 2019: (completed)

- Permits; Surveys; Pre-Con photos;
- Test pits for subaqueous water tunnel entry and exit pits
- Soil and water borings and sampling
- Tree removals / Site clearing

MOBILIZATION / Fall 2019: (completed)

- Tree Pruning / Installation of tree guards
- MPT/ Bus relocations (BX 29 and BXM 8)
- Installation of gravel access roads, site fence, silt fence, turbidity curtain, and goose exclusion fence
- Site setup/ Mobilization of equipment and materials

SUB-SURFACE WORK:(September 2019)

- Build out land and construct cofferdam on City Island Excavate entry and exit pits for Horizontal Direction Drilling (HDD)
- Tunnel two 2,000-ft-long subaqueous water tunnels by HDD method
- Layout & install 20” ductile iron water wain pipe inside 32” drilled steel sleeve pipe string and then pull pipe through the tunnels from the Bronx to City Island

Construction Sequence Cont'd

- Open-cut excavation for water main and storm sewers, catch basins and outfall

SURFACE WORK:

- Remove existing temporary steel watermain on the City Island Bridge
- Restore construction sites, plant trees, seed, and restore wetlands
- Restore roadway and streets
- Restore ADA sidewalks and crosswalks
- Restore Veteran's Memorial Triangle – As needed

Maintenance and Protection of Traffic

The NYC Dept. of Transportation's Office of Construction Mitigation and Coordination (DOT-OCMC) stipulated work hours will be:

City Island Avenue between City Island Bridge and Cross Street

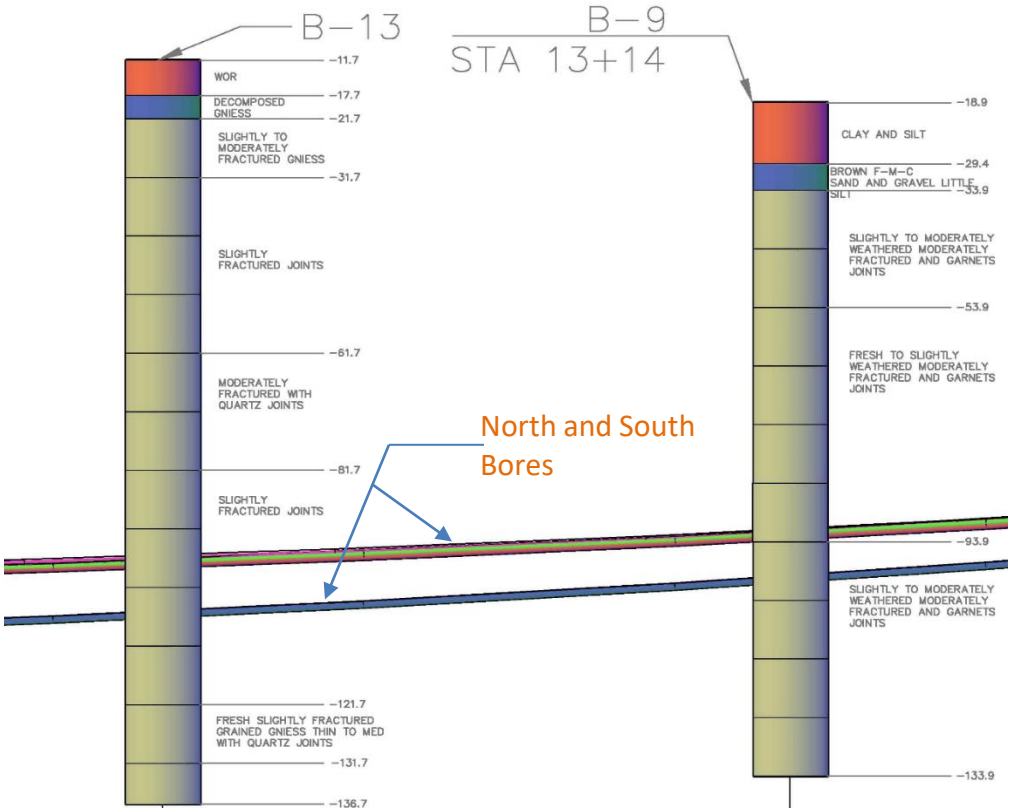
- 7:00am – 6:00pm, Mondays through Fridays
    - Typical work hours – 7:00am – 3:30pm
- 8:00am – 5:00pm, Saturdays (If/when necessary)

City Island Road between City Island Circle to City Island Bridge

- 7:00am – 6:00pm, Mondays through Fridays
    - Typical work hours – 7:00am – 3:30pm
- 8:00am – 5:00pm, Saturdays (If/when necessary

- Parking will be restricted while work is being performed.
- During working hours the contractor shall maintain one lane for emergency vehicles.
- After scheduled water shutdowns are completed, water service will be restored.

Subsurface Condition Bore Logs

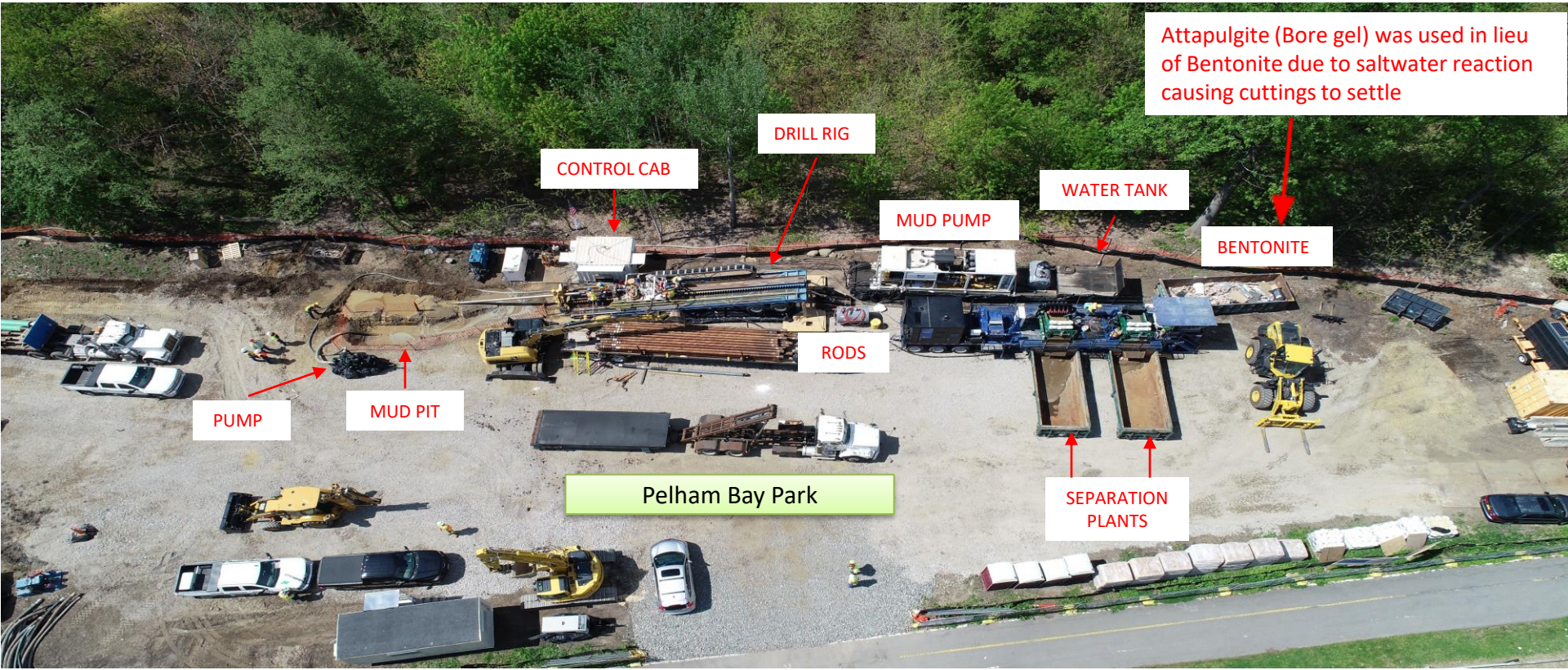


Exit Pit Coffer Dam

Pilot drill

HDD Equipment Mobilization

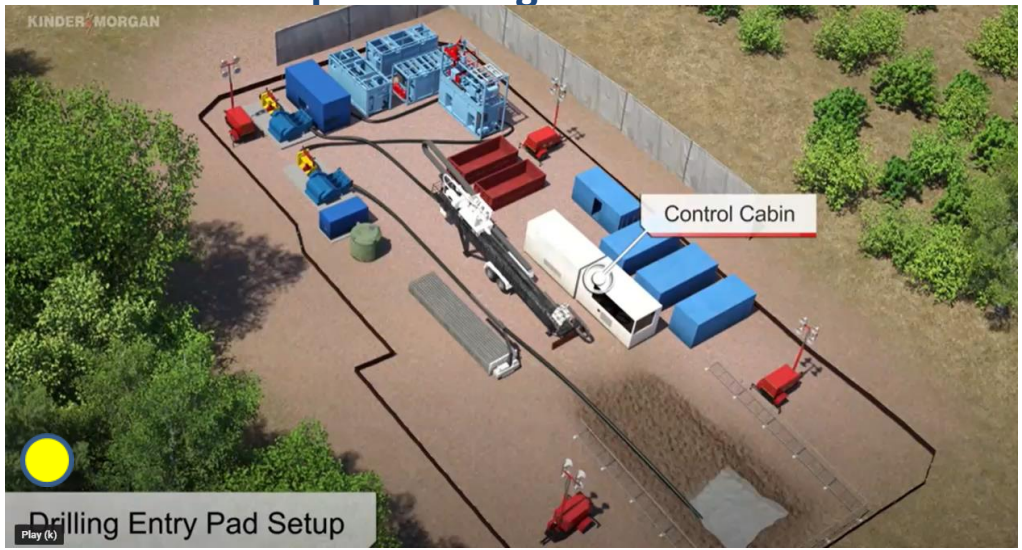
Laydown, work zone and Site Set-up



Horizontal Directional Drilling (HDD)

- **HDD Pipe Construction Sequence:**
  - Step 1: Drilling of 12” Pilot Bore
  - Step 2: Bore Reaming and Final Swab– Two Passes (30” & 44”)
  - Step 3: Install Steel Casing
  - Pull DIP Watermain

Step 1: Drilling Pilot Bore – Demo

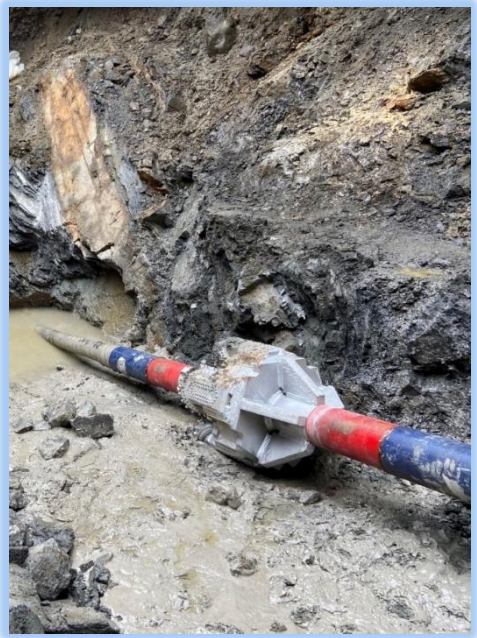


Video Clip Credits:
Morgan, Kinder [2016, July 20. ”Horizontal Directional Drilling”]. Retrieved from youtube.com

Horizontal Directional Drilling (HDD)- Explained

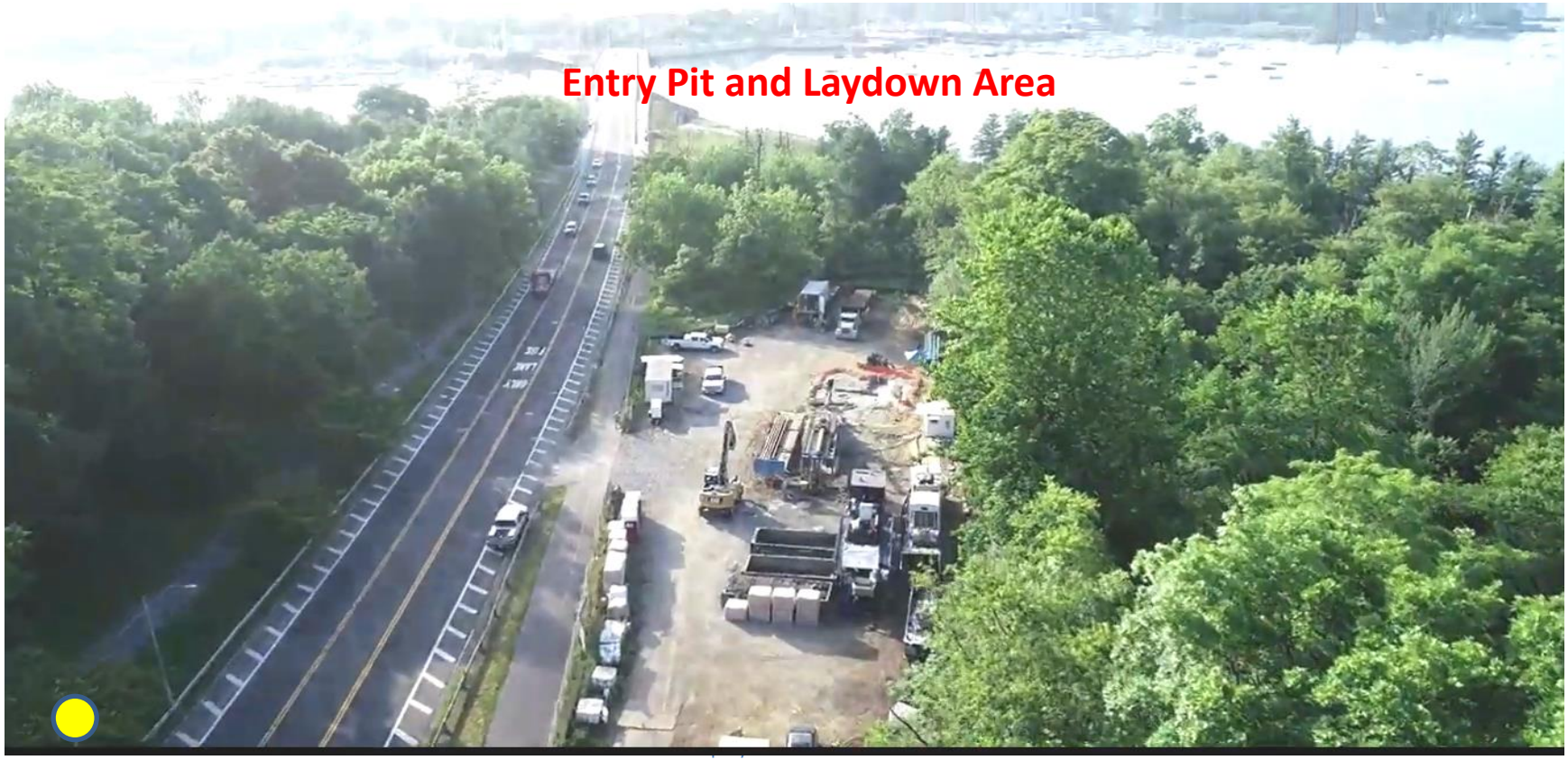
Step 2: Bore 30” Reaming (Second Pass)

Video Clip Credits:
Morgan, Kinder [2016, July 20. ”Horizontal Directional Drilling”]. Retrieved from youtube.com



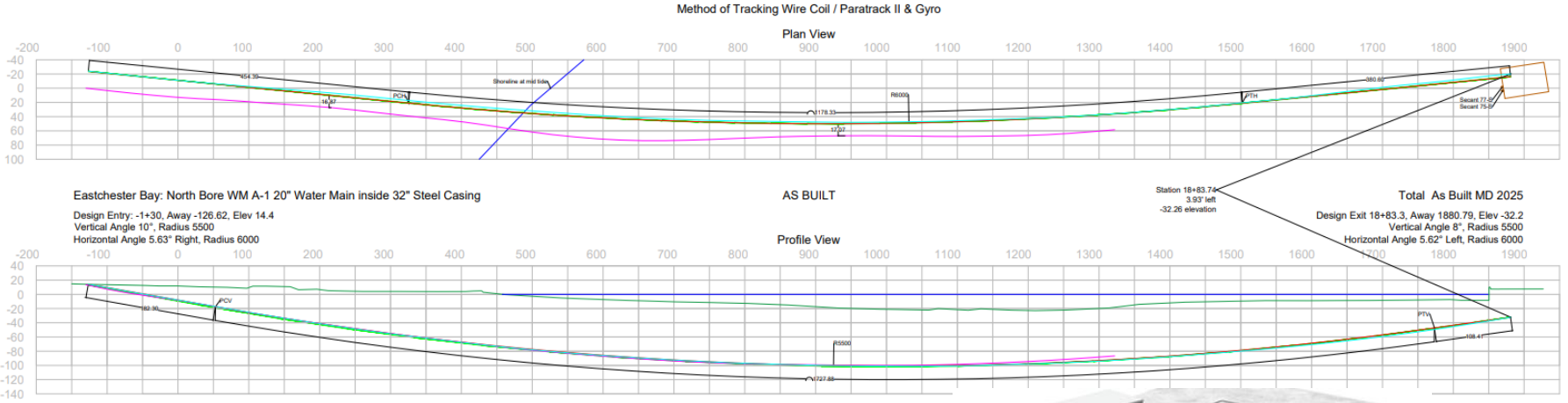
Commencement of 30” Reamer Pass pulled towards Pelham Bay Park – Entry Pit

IV. Construction Phase Progress Update



Report generated by Control Cab: Tracking Progress

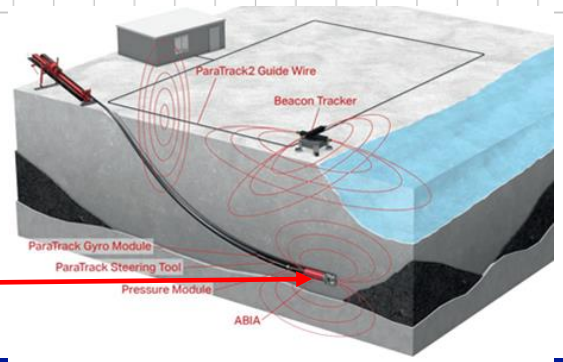
Field Verification Survey



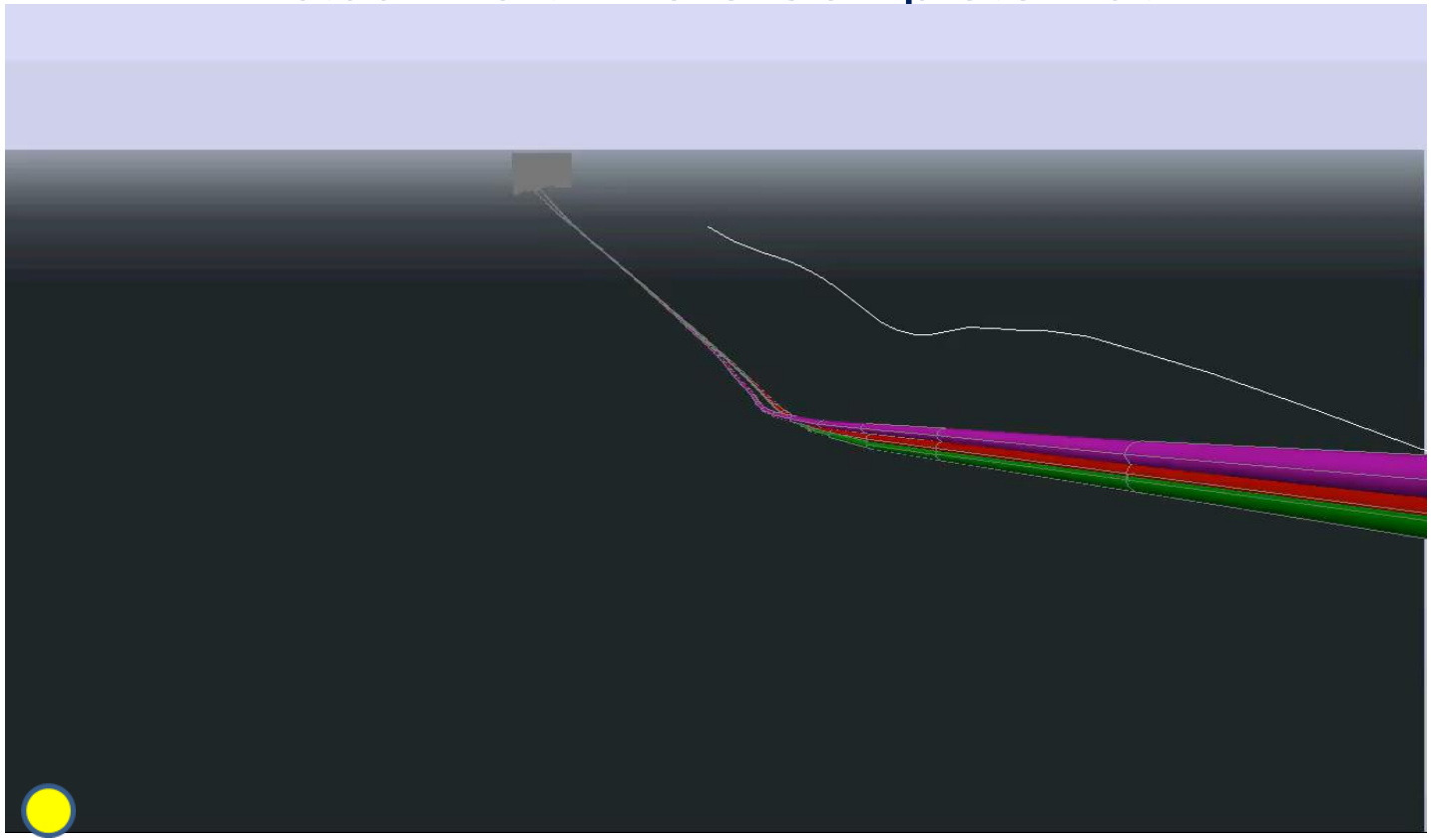
Legend:

- Ground Surface
- Proposed Profile
- North Pilot Progress
- Abandoned South Pilot
- Haley & Aldrich Designed Profile

Tracking System-Gyro Scope



Actual North Bore Complete Path



Legend:
Pink- As-built alignment
Red – ECI's target alignment
Green- H&A Design alignment

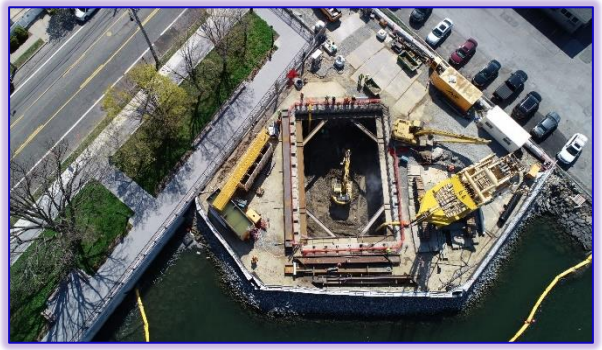
Produced by McMillen JA – B. Merchant

Progress Photos

Turbidity Barrier installed prior the construction of the land build-out to avoid sediments travelling to the Bay

Land Build Out construction continuation

Land Build Out and Cofferdam Footprint



Exit Pit / Full Depth Excavation

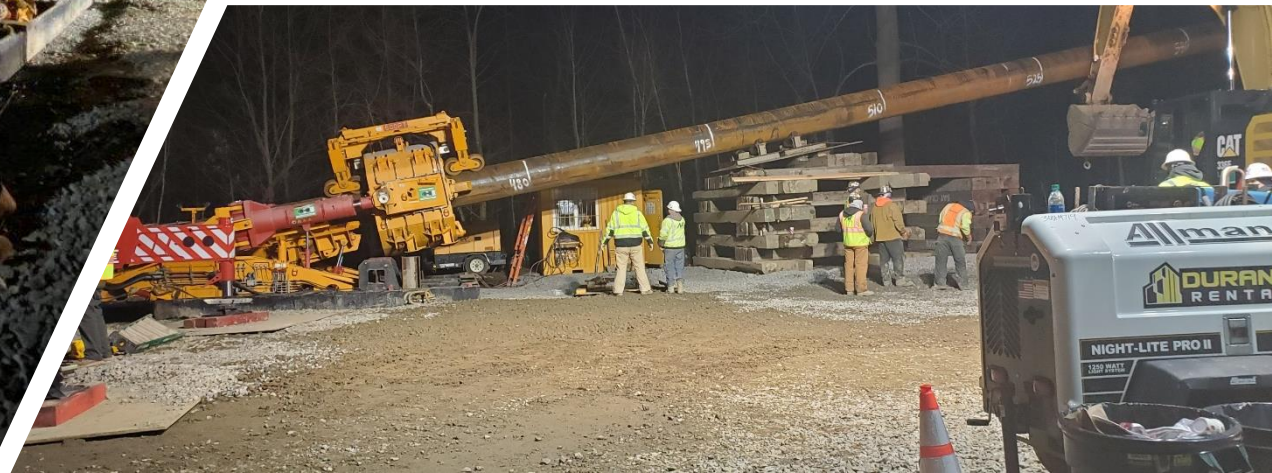
Pilot Bore Drill Bit

Set up of Drill Rig

HED564 - City Island tunnel casing Pipe welding and insertion of 700 LF sections.

HED564 - City Island tunnel casing insertion, **day and night** shifts operations completed last week. 2000 LF for tunnel #1 installed in 3 days. Tunnel #2 is in progress.

Pipe thrusting operation is a new technology in the United States and is more efficient than HDD pipe pulling. This machine setup is capable of a Maximum thrust of one million pounds.




HED564 - City Island tunnel casing Pipe insertion activities completed last week.

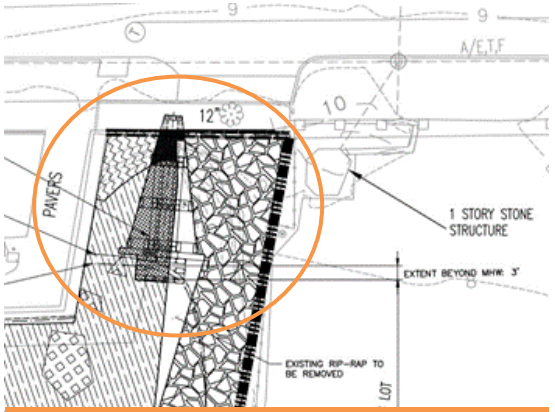
Progress Video

Entry pit and pipe thrusting operation

Construction Scope of Work

- **Installation of Water Main:**

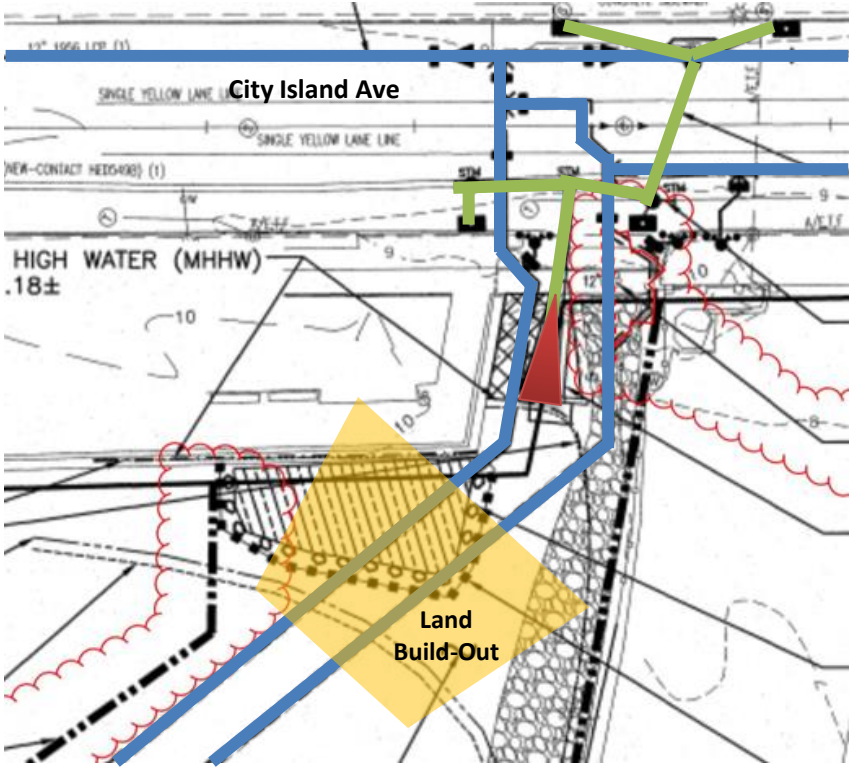
- **Installation of Storm Sewer:**



Sewer Outfall at City Island Ave

- **Removal, Pruning and Installations of Trees:**

Near Surface Water Main Connection Work



Proposed Water Main Distribution at Exit Pit

Legend
Green : Sewer Line
Red: Sewer Outfall
Blue : Water Line

V. Summary

Construction Challenge Summary

- **Alignment/Abandonment of initial south bore due to electronic interference of bridge utilities:**
  - Shift from Wire Line guidance to Gyroscopic guidance
- **Grouting of lengthy abandoned boring**
  - Abandoned utilizing tremie injection of 4,000psi grout
- **Saltwater intrusion**
  - Reaction with bentonite – cause cuttings to settle
  - Mitigated by attapulgite in lieu of bentonite to suspend solids in drilling fluid
- **Monitoring daily progress and ensuring the minimum radius is not exceeded**
- **Hard/Abrasive rock in the area**
  - Frequent cutting tool replacement
- **Tooling wear – low production**
  - Replacement of boring bits and reamer heads extended drill time

Construction Challenge Summary

- **Covid-19 Pandemic impact**
  - Social distancing and crew adapting to use of additional protective equipment
  - Staggering of field office personnel
  - Video conferencing in lieu of meetings
  - Travel restriction and strict quarantine guidelines

- **Inadequate laydown area in both Pelham Bay and City Island**
  - Acquire access for pipe string assembly sufficient for 2,000 ft of casing
  - 252 Trees had to be cut to establish required work zone and laydown area
  - Temporary Land build-out to accommodate coffer dam construction

DDC Project staff

Name

Design Engineer-In –Charge ---------- Robert Castelli, P.E.
Design Engineer ---------- Bhavisha Doshi
Sr. Project Manager---------- A.H.M. Choudury
Construction Borough Director ---------- Lambert L. Monah, P.E.
Construction Deputy Director---------- Franco Mesiti
Construction Engineer-In-Charge---------- Eric J. Sattler, P.E. & Ketty Paulino
Community Construction Liaison---------- Maria Caminero

Project Information

Design:

Project designed by Dewberry

HDD General Contractor:

Northeast Remsco Construction

- Responsive Bid price:$26.3M
- Land Build-out = $1.8M
- NTP Date = Nov. 13, 2018
- Contract Duration = 945 Calendar days

Resident Engineer/Inspection Team:

McMillen Jacobs Associates - JAU Underground

Resident Engineer---------- Maidie Erickson, P.E.

Department of Design and Construction

THANK YOU

QUESTIONS ?

Presented by:

Eric C Macfarlane, P.E., M.ASCE, NAC, ENV-SP
Deputy Commissioner

Ali Mallick, P.E.
Assistant Commissioner

Question #1

HED564 is a DEP sponsored project for replacing a 100 Yrs. old Cast Iron water main supply line to City Island, Bx. What are some key design elements?

1. Horizontal Directional Drilling (HDD) of 2 – 2000 LF subaqueous tunnels
2. Installation of 2 – 20in dia DI water mains
3. Construction of a new storm sewer outfall at City Island
4. Remove existing temporary steel water main on City Island bridge

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4. Remove existing temporary steel water main on City Island bridge
5. All of the above

Question #2

Among various design considerations the following are true ?

1. Entry pits an HDD laydown were restricted to Pelham bay park
2. 5500 Lf horizontal curves radius to avoid subsurface obstacles
3. Easement was required over water at City Island side
4. All of the above

Question #2

Among various design considerations the following which is/are true ?

1. Entry pits an HDD laydown were restricted to Pelham bay park
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4. All of the above

Question #3

What design listed risks below are correct ?

1. Need to identify and allocate laydown are for HDD casing assembly and pullback
2. Elimination of compound curves to reduce bending stresses on steel casings having to pull though horizontal and vertical curves
3. Line and grade control to develop parallel bore paths to exit site

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Question #3

What subsurface conditions were found based on borings logs investigation ?

1. Drill paths for the proposed water mains tunnels pass through fresh slightly fractured grained gneiss
2. Drill paths for water main tunnels pass through clay formation
3. Drill paths for water main tunnels pass through solid rock

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4. Correct answer is #1