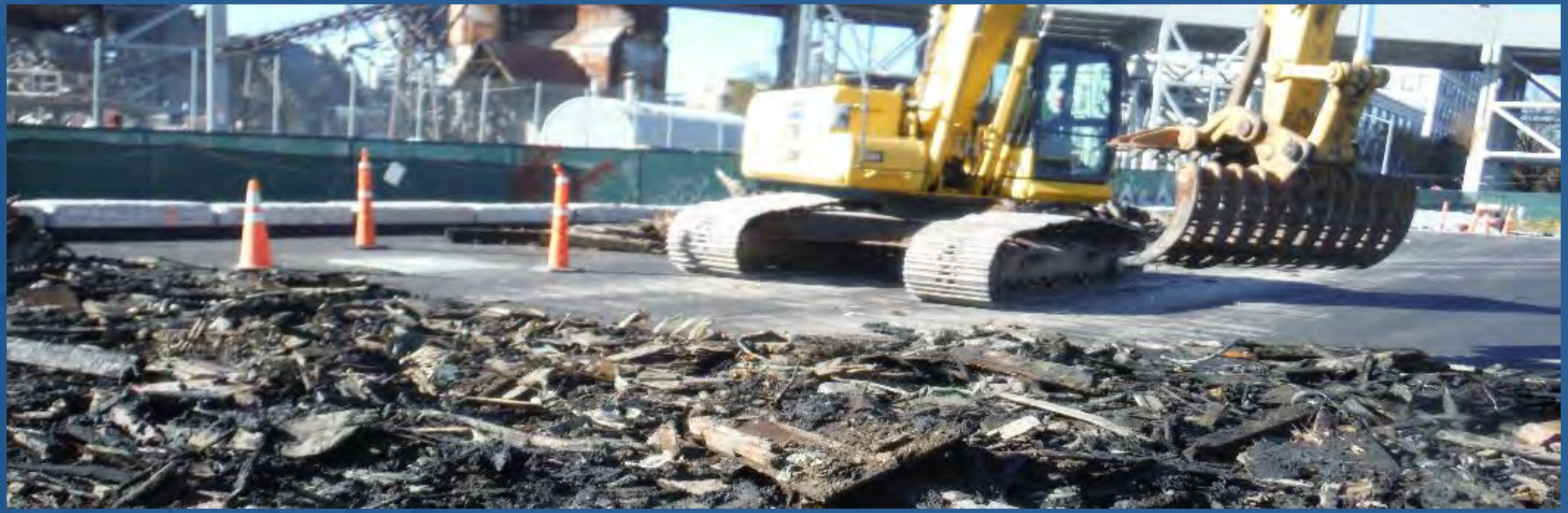


Management of Dredged Debris during the Gowanus Canal Pilot Study

Darrell Nicholas, PE

Geosyntec consultants

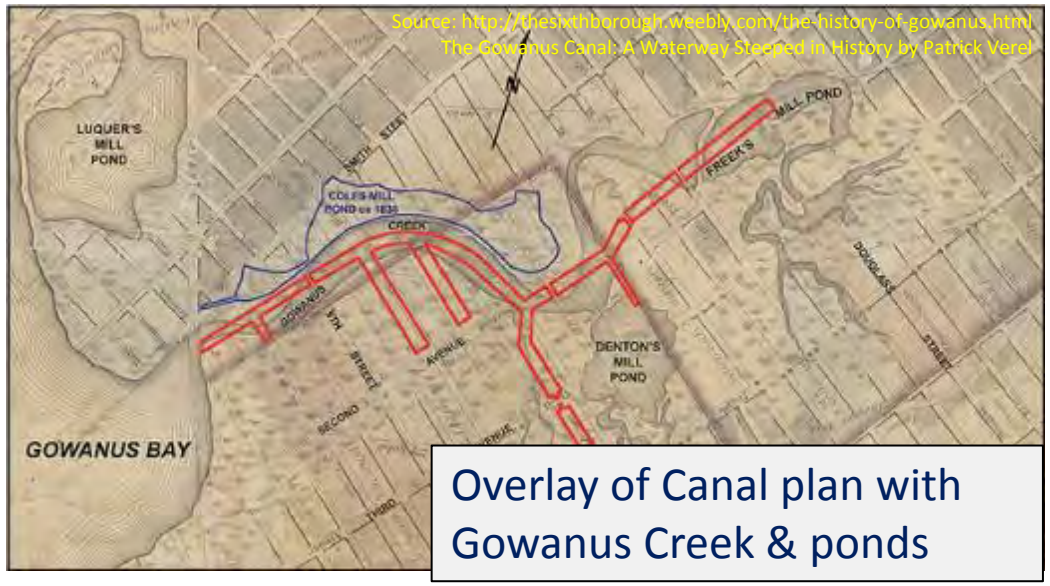
Authors: Darrell Nicholas, PE: Jeremy Gasser, PE; Panos Andonyadis, PE; Dave Himmelheber, PhD, PE
10th International Conference on Remediation & Management of Contaminated Sediments
February 11-14, 2019, New Orleans, LA

Welcome to Tennessee

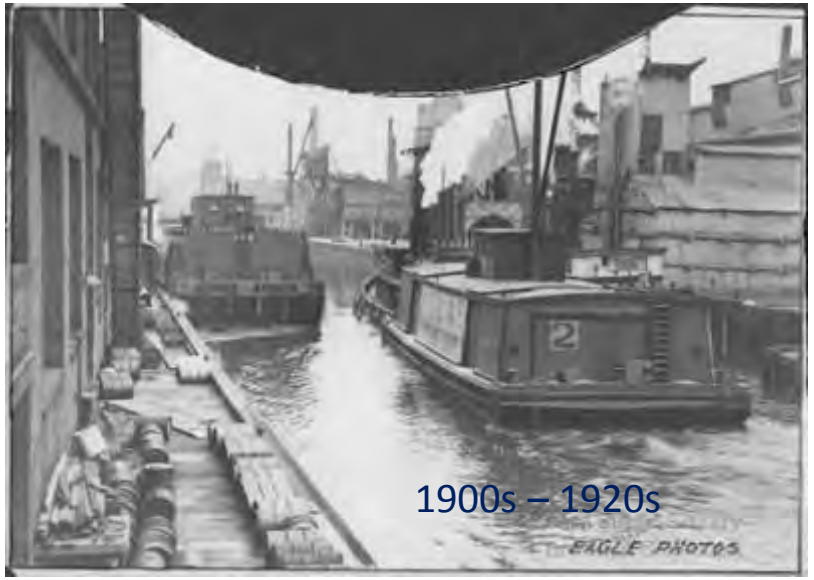
Presentation Preview

- Gowanus Canal Brief History and Background
- Major Remedial Design Components
- Debris Sources and Investigation Results
- Debris Removal Pilot Study
- Archaeological Evaluations
- Environmental Monitoring
- Design & Construction Impacts

Gowanus Canal Early History



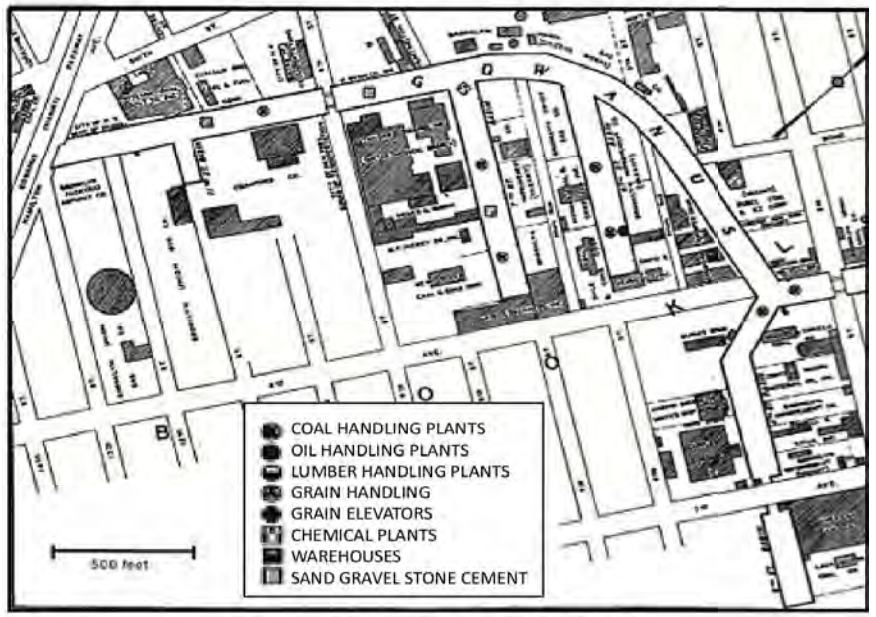
Overlay of Canal plan with Gowanus Creek & ponds



- Settled by Dutch: 1600s
- Canal authorized: 1848
- Construction and draining of wetlands: 1853 – 1869
- Terminus of Erie Canal transportation system
  - Raw material for commerce and industries
  - Finished goods to Western USA

Gowanus Canal - The Legacy of a Nation's Growth

Source: http://thesixthborough.weebly.com/the-history-of-gowanus.html
The Gowanus Canal: A Waterway Steeped in History by Patrick Verel



INDUSTRIES OF GOWANUS CANAL (CA. 1942)

- Rapid development – 1870 to 1920s
- Peak operation - 25,000 vessel trips/year
- 60 dock facilities, dozens of industries
- Declining barge traffic with the rise of trucking
- Last Dredging in 1950s

Gowanus Canal Superfund Site
Today's Urban Setting

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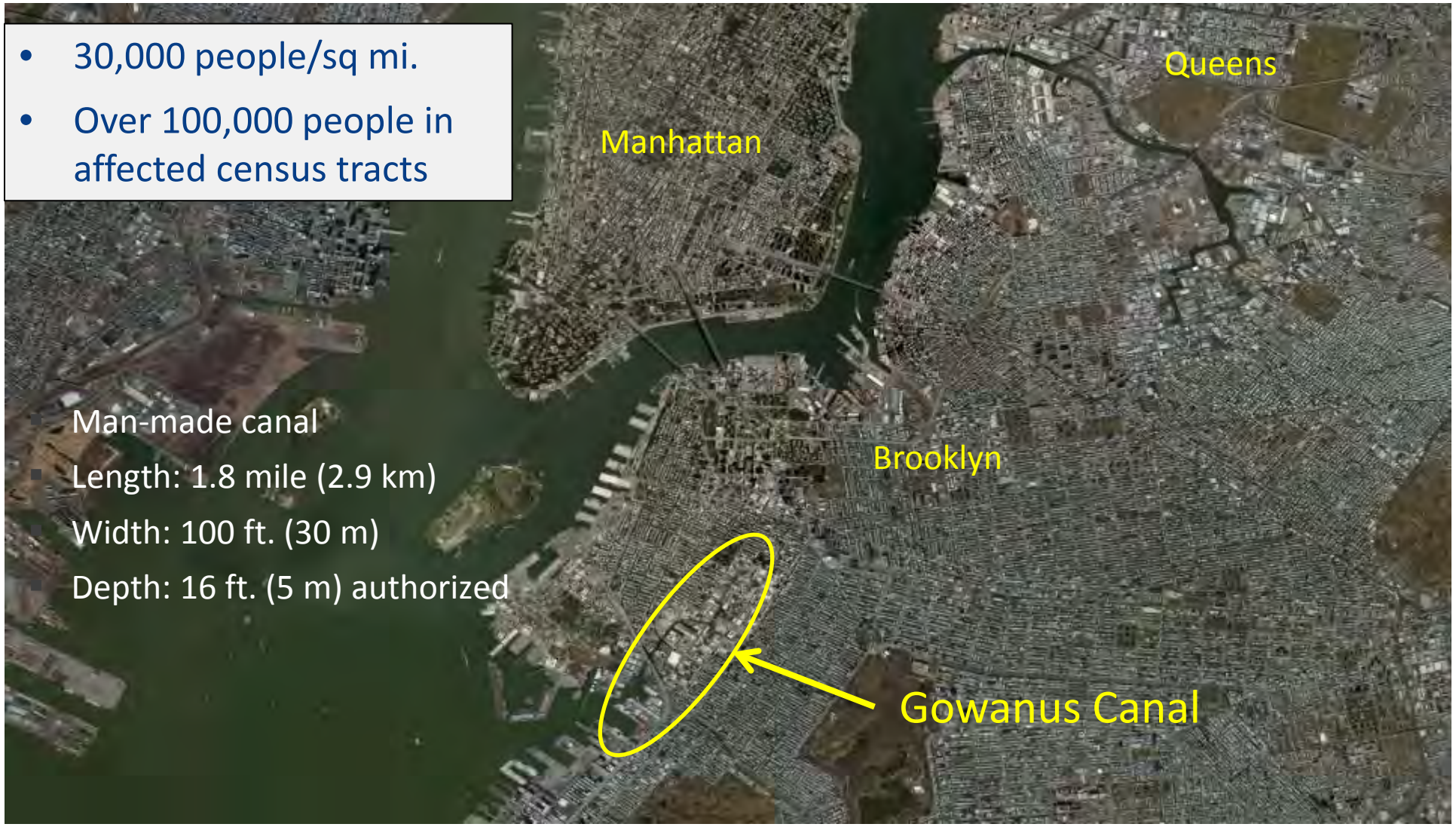
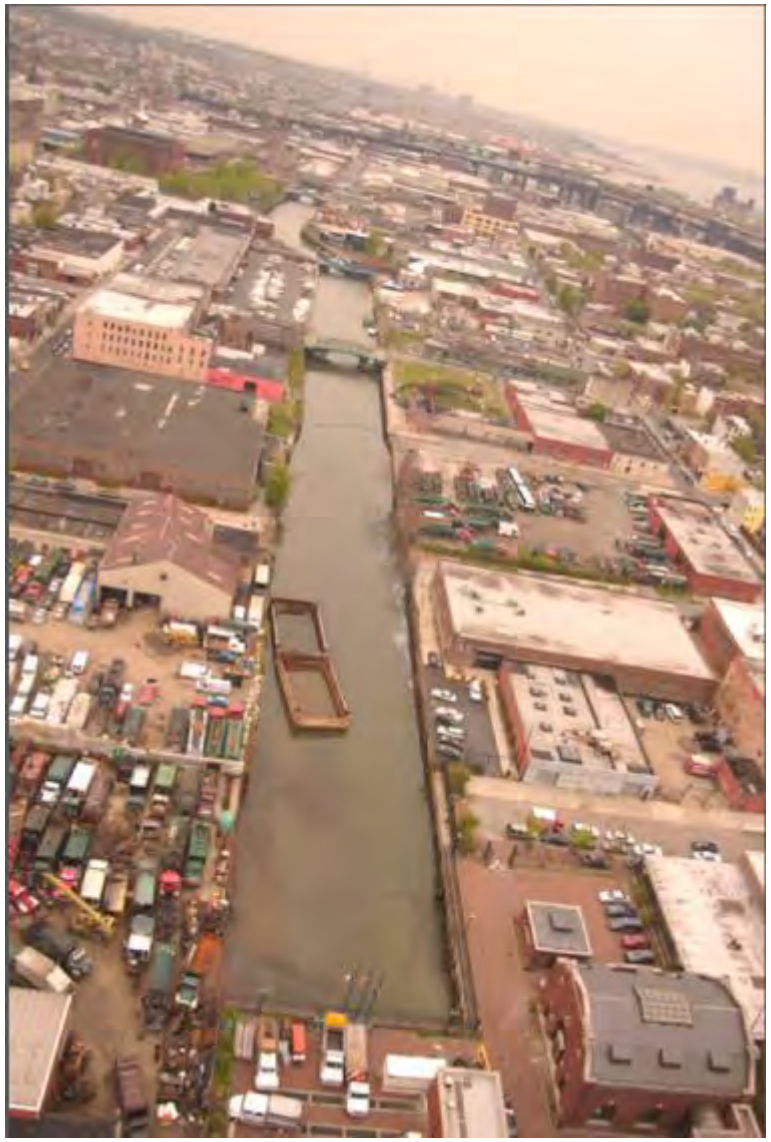


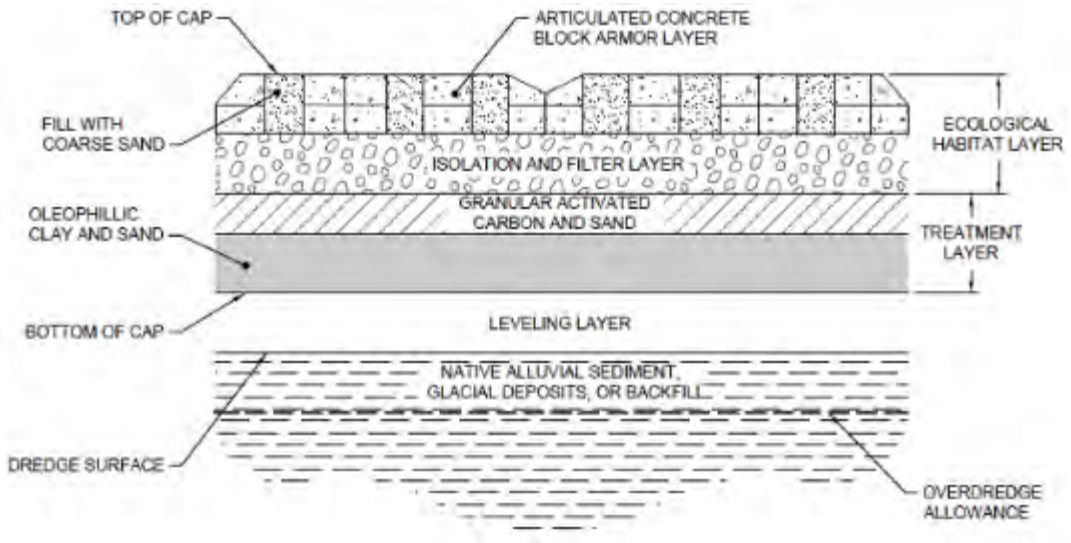
Gowanus Canal Superfund Site
EPA Actions

- PAHs
- Heavy Metals
- PCBs
- Sewage



- **Mar 2010**
  National Priorities List
- **Jan 2011**
  Remedial Investigation
- **Dec 2012**
  Feasibility Study
- **Sept 2013**
  Record of Decision

Gowanus Canal Superfund Site
Major Remedy Components



- Dredging
- Bulkhead repairs
- Ex-situ treatment
- Dredge water treatment
- In-situ stabilization
- Capping

4th Street Turning Basin Pilot Study

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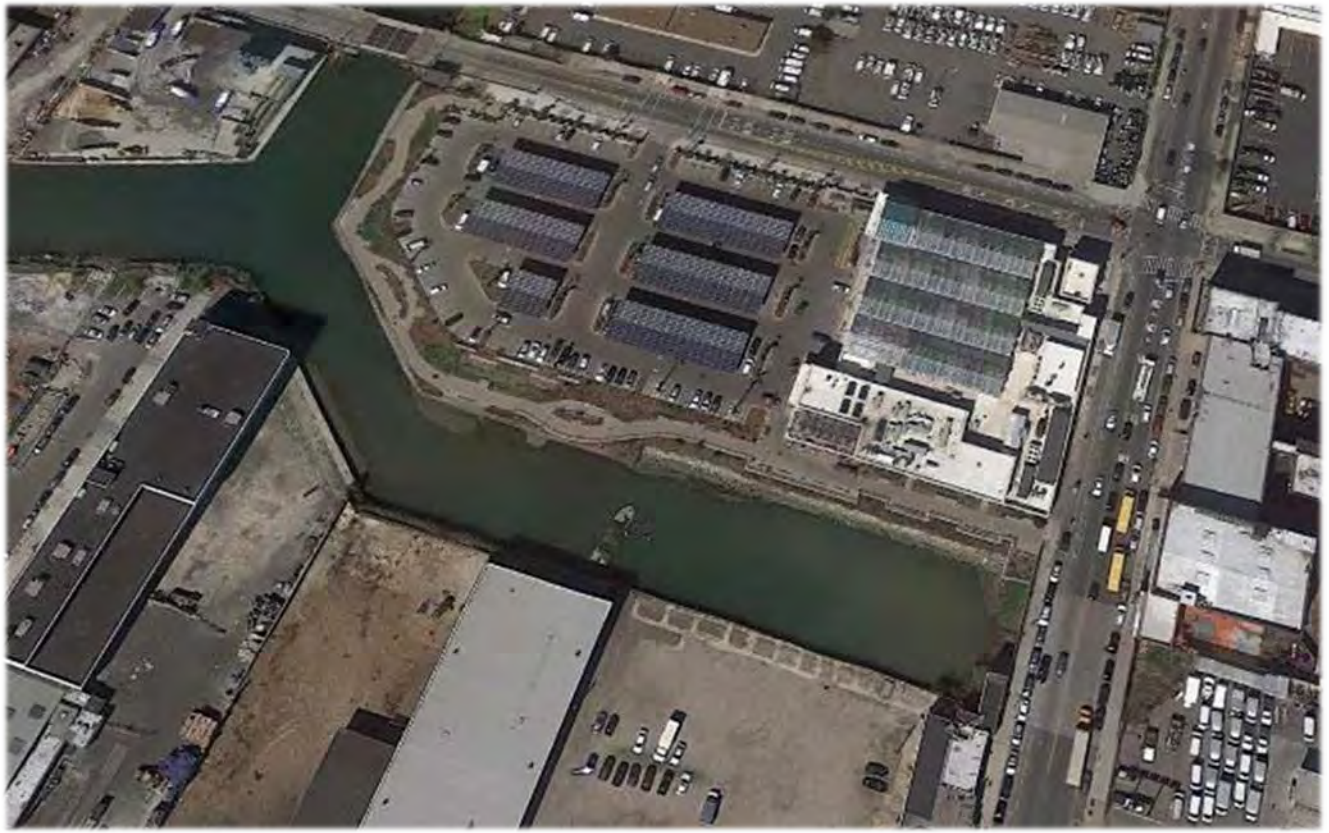
❑ Comprehensive Pilot Study

- Site Staging, Debris Removal, Bulkhead Installation, Dredging, Sediment Processing & Disposal, Water Treatment, Capping

1. Test different equipment, means and methods
2. Confirm design assumptions and validate approaches
3. Evaluate environmental monitoring approaches for water quality and air/odor quality
4. Develop community confidence in the remedy



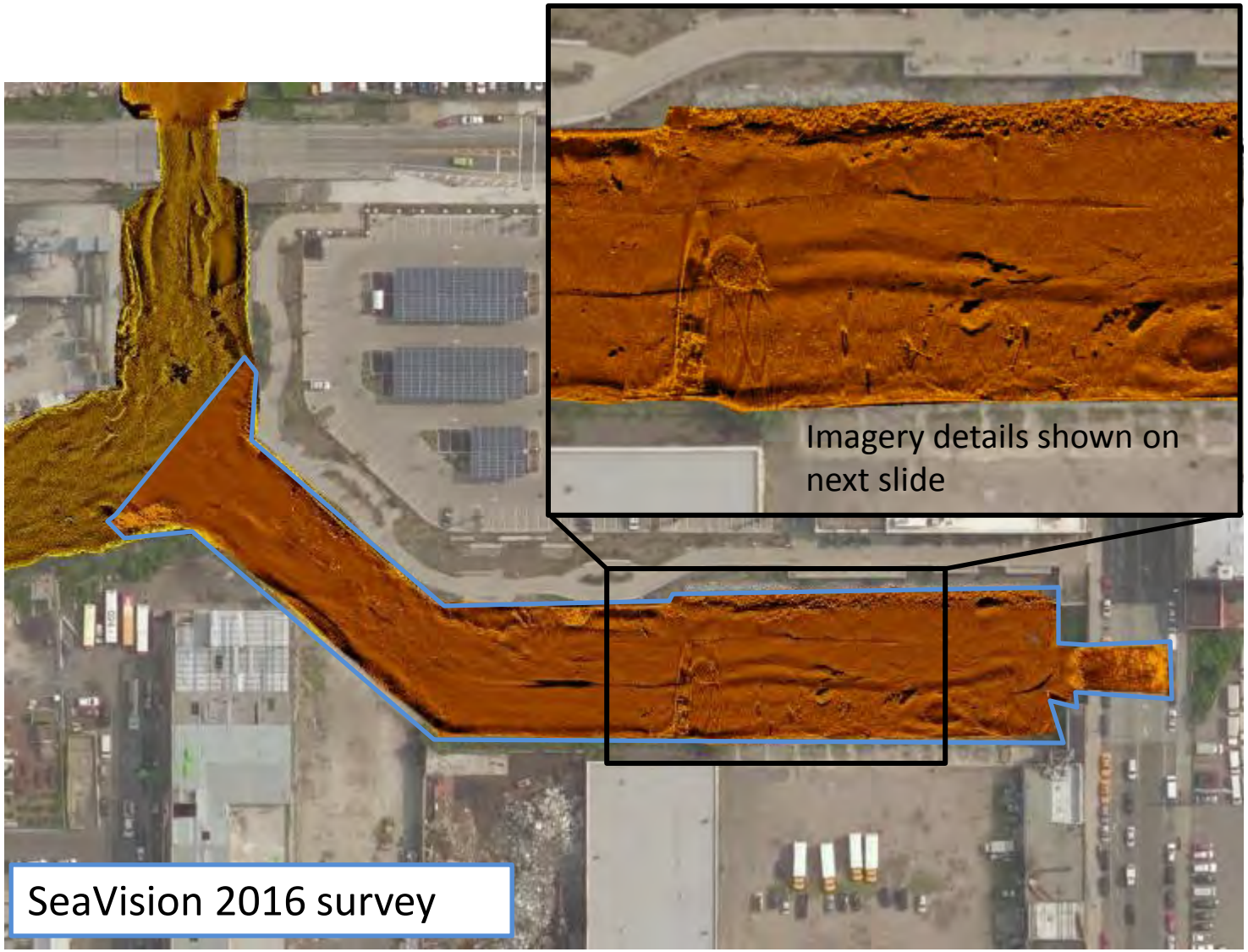
Design Considerations: Debris

Our Experience:
Failure to consider debris removal impacts is one of the single largest cause of significant cost and budget overruns on sediment remediation projects.

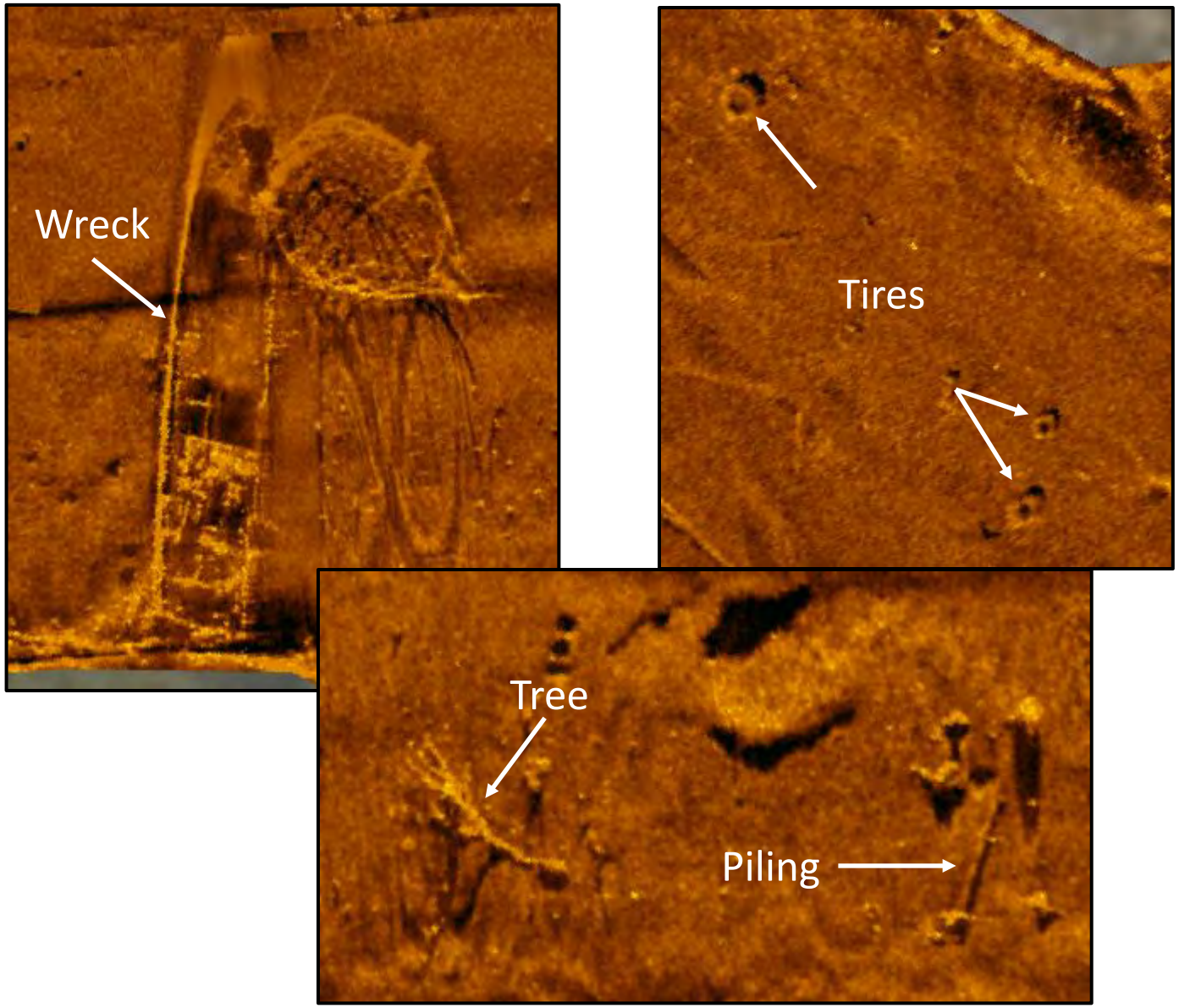
Design Considerations - Debris Sources

- Shipwrecks
- Scrapyards
- Failing Bulkheads
- Piers, Piling, Docks
- CSOs
- Demolition
- Open Dumping

2016 High Resolution Side Scan Sonar Imagery

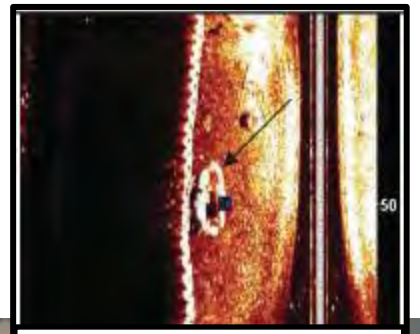


2016 Survey Target Details

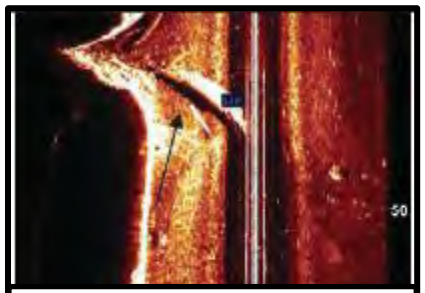


Submerged Potential Cultural Resources

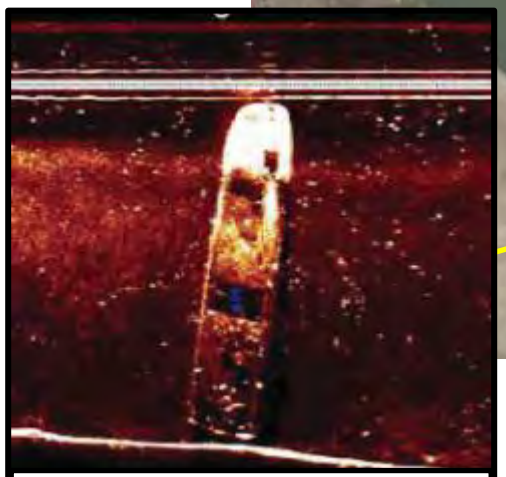
Three potential cultural resources identified in 2010 sonar survey



31: Small vessel*



31b: Rectangular feature



31a: Sunken Boat Hull

***Note**: Target 31 migrated south from its location at mouth of canal observed in 2010 to the location shown above

Key Objectives - Debris Removal Pilot Test

1. Clear large obstructions from 4th Street Turning Basin which prevent navigational access
2. Evaluate different equipment types to efficiently remove debris and evaluate processes for managing debris:
    a. Debris cleaning handling & storage
    b. Archaeological profiling
    c. Water treatment and reuse
    d. Limited sediment processing
3. Evaluate environmental monitoring approaches for water quality and air/odor quality

Assessment of Potential Cultural Resources

Historical assessment conducted in 2016 (AHRS)

- **31: Small Vessel**
  - Metal motor boat
  - Migrated south since 2010 survey
- **31a: Sunken Boat Hull**
  - Former WWII era “crash boat”
- **31b: Rectangular Feature**
  - Appears to be related to collapsed bulkhead

- No objects of significant archaeological value
- None are eligible for listing in the National Register of Historic Places


French, 2016


Hyatt, 2016


French, 2016

Debris Removal Targets

The following debris removed during the pilot study:

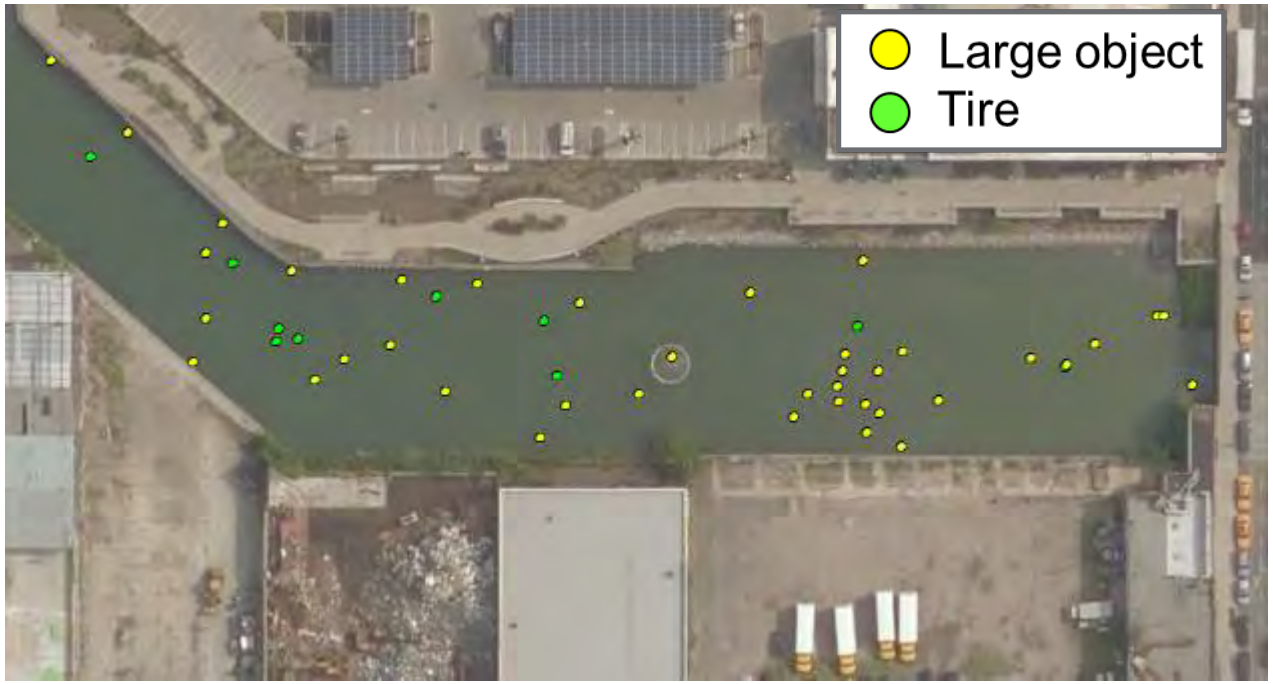
- Large debris items identified in 2016 survey
- Debris fields at the mouth of the 4th Street Turning Basin
  - Determine nature and extent of buried debris
  - Compare actual versus predicted volumes

Removal Targets: 2016 Survey Large Debris

Large debris items (> 5 feet in any dimension) will be removed

36 targets:

- 2 wrecks
- 8 pilings
- 1 tree
- 25 other



Tires will be removed and managed separately

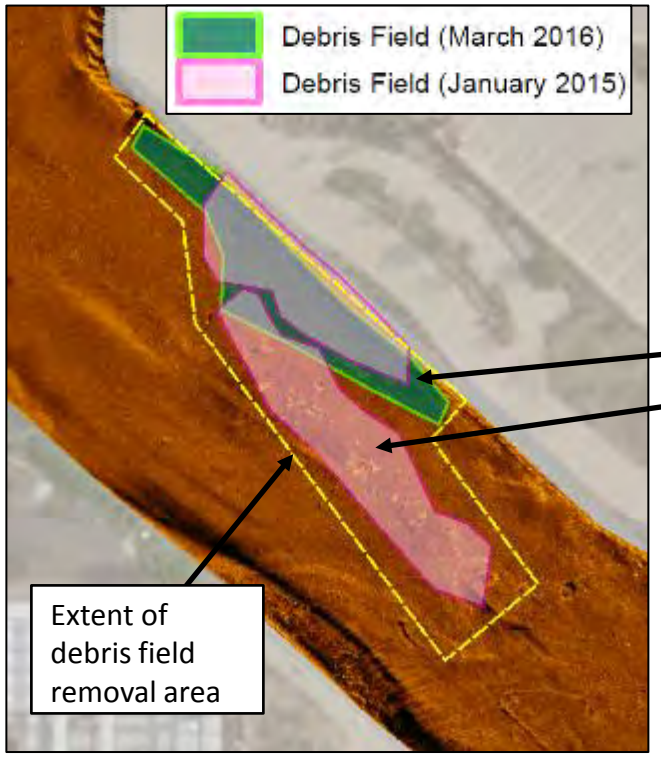
Large Debris Removal

- Removal of 36 large debris targets and 10 tires
- Evaluation of 5-tined grapple and rake

Attachment	Targets Attempted	Targets Removed	Removal Rate	Total Duration (min)	Duration per Target (min)
Grapple	14	10	71%	165	12
Rake	32	21	66%	450	14

Removal Targets: Debris Fields

- **Debris Fields:** Large swaths of Canal bottom that are filled with debris targets
- Debris fields identified in 2015 and 2016 surveys that obstruct navigation and potentially affect bulkhead construction



	Approximate Volume* (cubic yards)	
Approximate Debris Coverage	**Sediment**	**Debris**
20%	135	20
30%	140	30
Total	**275**	**50**

*Assuming 2-ft removal depth

325 CY of material = approximately one barge load of sediment & debris

Debris Field Removal and Evaluation

- Evaluate actual versus estimated debris coverage in the debris field at mouth of turning basin
  - Use 2-ft deep bucket cuts
  - Preliminary volume calculations based on side scan coverage estimates
  - Refine volume calculations after preliminary cuts
- Determine nature and extent of debris buried below the sediment surface

Debris Field Removal

- 250 cubic meters (CM) of sediment/debris removed
- Evaluated two bucket types
  - 1.1 CM environmental
  - 1.9 CM conventional
- Evaluated three scow loading techniques

10-cm screen

Directly into scow

10-cm grizzly bars

Debris Field Removal

Geosyntec consultants

Production Evaluation	Scow 1	Scow 2	Scow 3	Scow 4
Scow Volume (CM)	55	60	68	70
Total AVG Cycle Time (sec)	193	92	127	137
Total Scow Load Time (hr)	4.5	2.8	2.7	3.6
Total Lost Time (hrs)	2.2	N/A	N/A	0.6
Total Scow Time w/ Material Rehandle (hrs)	4.5	3.3	3.2	3.6
Percent Buckets w/ Lost Time	44%	N/A	N/A	19%
Average Bucket Percentage	58%	40%	47%	38%

- Extended cycle times associated with loading scows through a screen
- Negligible difference between direct loading plus rehandling and loading directly through grizzly bars

In-barge Sediment & Debris Processing
Archaeological Evaluation

Geosyntec consultants

- All debris offloaded to an asphalt pad for inspection
- Sediment stabilized with Portland cement
- All material discarded at permitted landfills
- Limited quantities of recyclable material

Off-site Sediment Processing & Debris Removal
Archaeological Evaluation

Environmental Monitoring

- Silt curtain during large debris removal
- Air curtain during debris field removal
- Noise monitoring
- Air monitoring
- Water quality monitoring
  - Turbidity buoys
  - Turbidity/TSS measurements

Plume Generation and Turbidity

Geosyntec consultants

Description of In-Canal Activity	AVG Turbidity in Plume (NTU)	MAX Turbidity in Plume (NTU)	AVG Distance from Source of Sediment Resuspension (m)	Number of Measurements
Large Debris Removal with Grapple	21.8	25.0	18	2
Large Debris Removal with Rake	23.6	32.0	18	4
Debris Field Removal with Environmental Clamshell Bucket	9.9	26.9	9	87
Debris Field Removal with Conventional Clamshell Bucket	16.8	27.1	13	35
Movement of Barges with Push Boat	46.3	155	30	28

Observations from TB4 Dredging

- **Large amounts of debris encountered**
  - Debris vertically distributed throughout the soft sediment
  - Pilot study removed about 3,500 CY of debris
  - Debris was roughly 5% of the total volume removed excluding shipwrecks
- **Debris Separation and Sediment Processing**
  - Multiple 4” vibrating deck screen used off-site at Clean Earth
  - 6” grizzly used with in-barge mixing process.

Obstructions and Conventional Pile Driving

- Conventional pile driving: Vibratory hammers and impact hammers
- Limitations to handling obstructions
  - Shallow obstructions, less than 10’ below the mudline, could be removed
  - Sheet piles cannot penetrate through materials such as concrete, timber, or steel
  - Deep obstructions often cannot be removed
  - Often the wall alignment becomes impacted to avoid obstructions that cannot be removed
  - Attempting to drive through obstructions can generate high levels of vibrations

Obstructions and Hydraulic Pile Press

- Hydraulic press system tested to push and advance a sheet pile to target depths
- Attachments such as a water jet or auger can be used to assist the press process
- Limitations to handling obstructions
  - The press has a limit of downward pressing force
  - Press is less capable of breaking or advancing past obstruction than the conventional methods
  - The press method may push obstructions with the pile if the ground is soft
  - The auger attachment can help break through concrete debris

Photo: Hydraulic press setting a pile

Obstructions and Lessons Learned - Hydraulic Pile Press

- Penetrating obstructions with an auger attachment
  - Auger can handle some obstructions, but can be damaged
  - Adds significant time to the pile driving operation
- Pile maneuvering
  - An operator can make adjustments to maneuver around obstructions
  - Only applicable if limited movement clears an obstruction

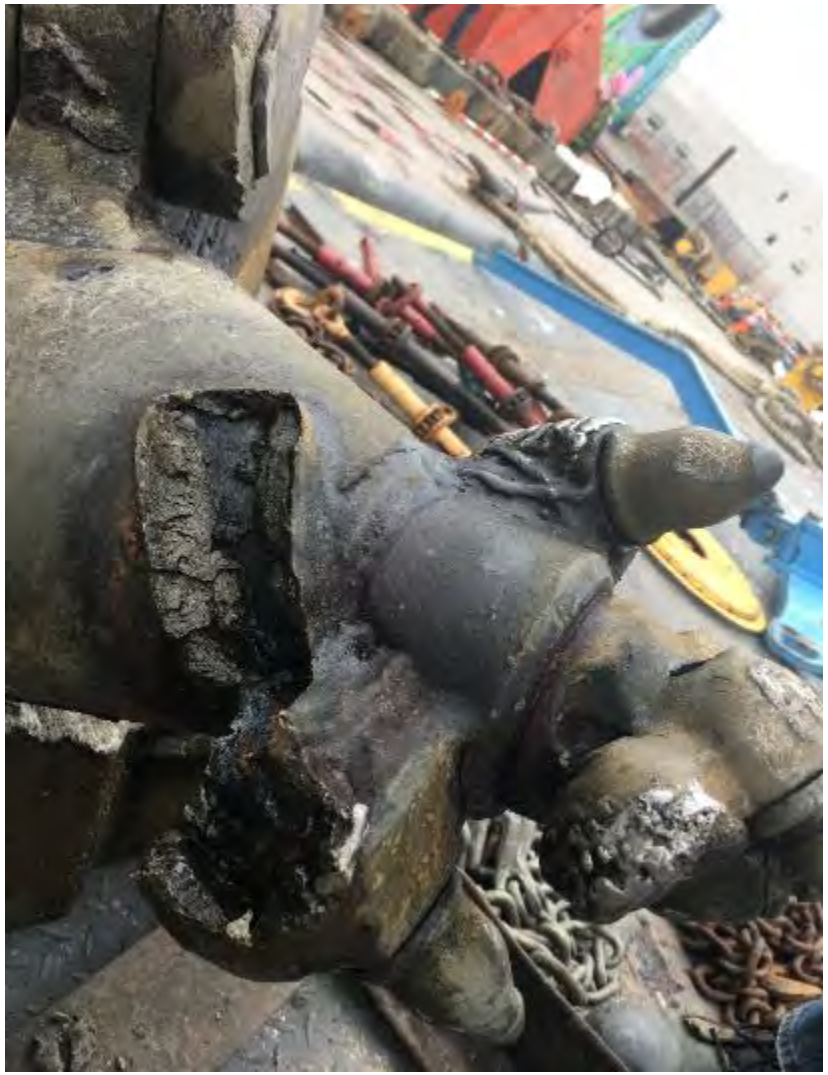


Photo: Auger damaged during drilling through obstructions

Acknowledgments

- Gowanus Environmental Remediation Trust
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- Archaeology and Historic Resources Services
- Clean Earth
- Local Residents and Businesses

Questions?

Contact Information:
Darrell Nicholas, P.E.
Email: dnicholas@geosyntec.com
Phone: (865) 291-4706
Licensed in FL