

# Alternatives to Aquatic Placement Applying Regional Sediment Manufacturing to Innovative Stabilization for Brownfields Beneficial Use

Tipping Point Resources Group, LLC - USA

10<sup>th</sup> International Conference  
SedNet – *Sediments on the Move*  
14 June 2017 / Genoa, Italy

*Disposal of Sediments at Sea Session*

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*Beneficial Use of Sediments and Soils Driving Sustainable Economic Growth*





# DEFEAT



the **MUCK MONSTER**



# Aquatic Placement Challenges / *Contaminated Sediments*



- Disposal/Placement Sites are at Capacity
  - ❑ Changes in Placement Criteria (more stringent)/ sed tox & bioacc
    - New Designation and/or Expansion - Siting Feasibility Studies is a long-term process
- CADs/CDFs (unless you have a Slufter)
  - Loss of benthic habitat and real estate
  - Impacts to critical fisheries/nurseries
  - Commitment to Long-term monitoring/life cycle costs + mitigation / liability
  - Public perception (depend who you ask....)
- Impedes technology development = crisis management = €€€ \$\$\$
- ❑ Decades of Pollution Prevention Programs / Investment ?
  - Growing Costs may Exceed the Benefits
- ❑ Dredged Material/Contaminated Sediments – Brownfield Integration
  - ❑ **Less Obvious than Obvious**



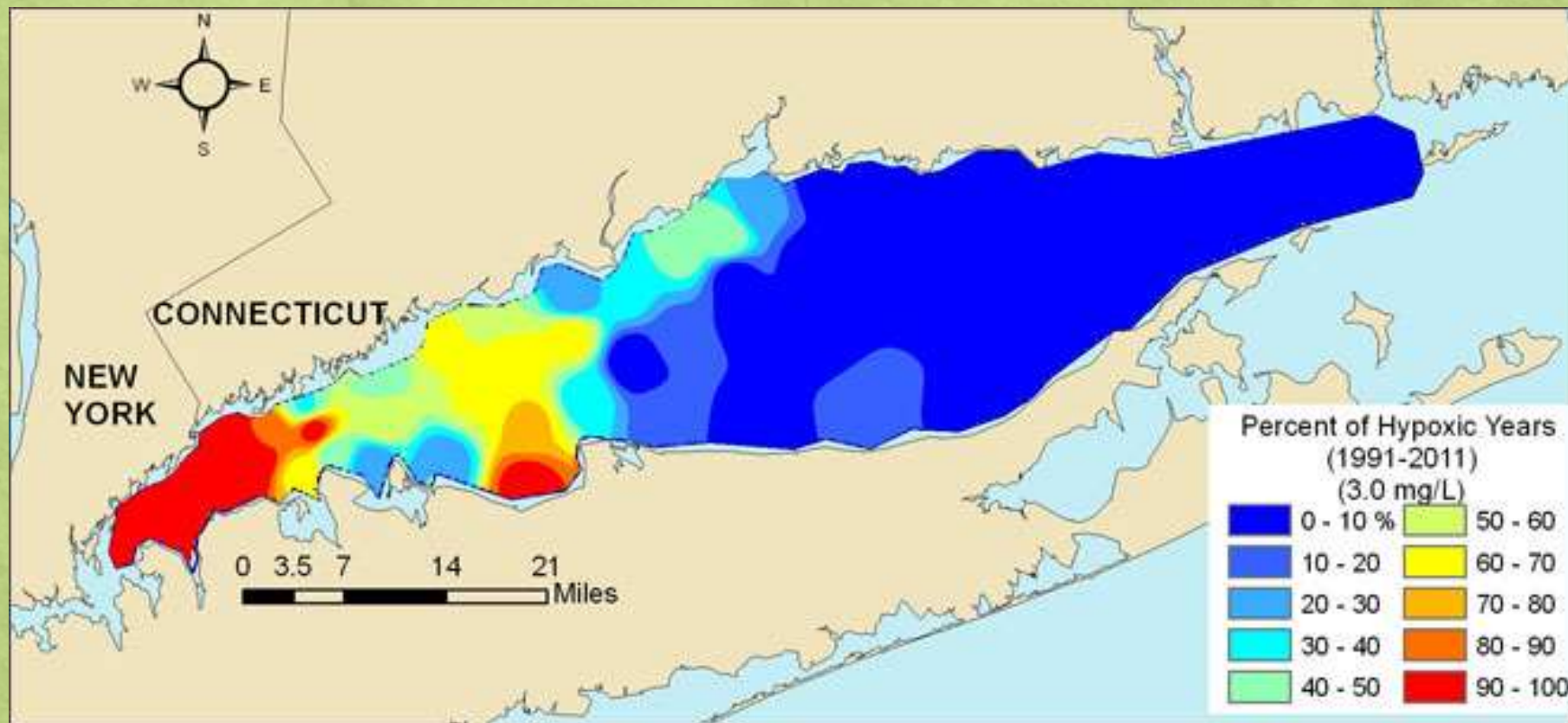


Ports:  
Bridgeport  
New Haven  
New London

## Connecticut









# Regional Manufacturing Facility Objective:

## Develop Long-term Self Sustaining Enterprises in the Urban Sediment Management of Contaminated Sediments

- Regional NY/NJ/New England Market
- Perfect Storm / 2 – 20 years
  - Aquatic placement challenges
    - Forgotten marinas, commercial / industrial, municipal
    - O&M
- Urban Sediment Centers
  - Common sharing of facility for multi-complex projects and technologies/processes
    - Urban Sediment Research Center (basic/applied)
    - Education, Job Training, Internships
- Technology Integration (front and back-end) / Barge to Rail to Placement
  - High / Moderate / Low Contamination
- Regional Beneficial Use / Brownfields
  - Manufactured Soils
  - Stabilized Structural Geotechnical Caps

Benefit: Captures a multi contaminant zone market that minimizes standard industry long haul and dump operation of sediments to landfills which realizes a future in other sustainable approaches



# Connecticut Regional Dredged Material Manufacturing Facility 2017/18 Campaign

- Anchor Waterfront Regional Facility

- New Haven Terminal
  - Rail to brownfields

- ❑ **Pneumatic Flow Tube Mixing Process (PFTM) / Stabilization**

- Pump to gondola Railroad cars and/or trucks via in barge processing
- Rail to Triangle Wire / Griswold, Connecticut
  - Brownfield residential/commercial development
- 2017/18 Dredging Window
  - 5735 m<sup>3</sup> (demonstration scale/process flow-economics)
  - 230,000 m<sup>3</sup> (2018/19) ++ (383m<sup>3</sup> /day to 1529 m<sup>3</sup> /day full operation)

- **PFTM Barge Design with Capability to Operate:**

(1) adjacent to land based staging area (small foot print) and pump into RR or trucks to brownfield placement site (s)

✓ (2) *on a barge to allow travel to a site and pump directly to site needing upland structural beneficial use material*





Heron  
Construction,  
Papakura,  
New Zealand



Bellingham,  
Washington USA  
Squalicum Harbor

EIS Associates, NY/NJ Harbor

**Dredged Material Cement Pug Mill  
Operations**





# Pneumatic Flow Tube Mixer and Transport Pipe / Flexibility Pipe and Materials Handling Design



Small footprint  
Pump long distances (1-3 km)



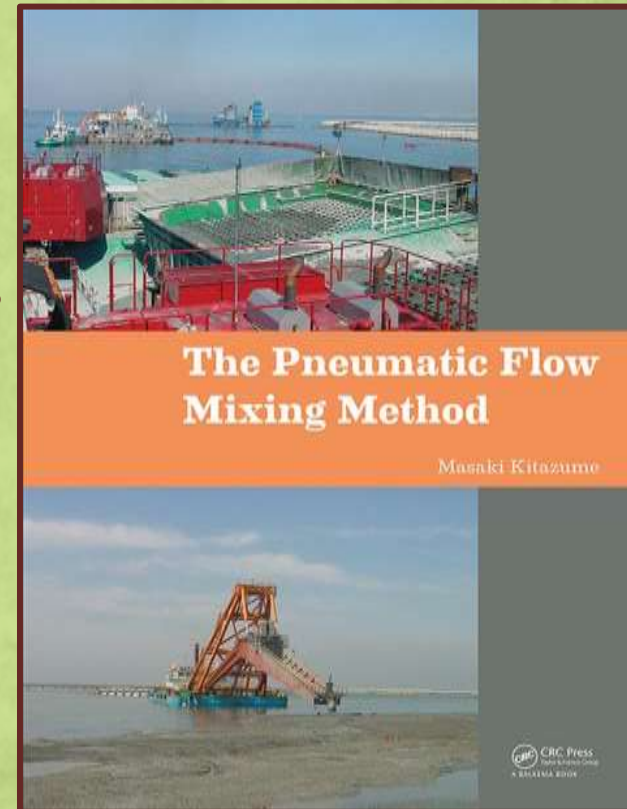
# PFTM Background



## Pneumatic Flow Tube Mixing

- Developed in Japan in early 2000 for large scale reclamation projects using fine silty clay sediments
- Many successful examples including reclamation works for Tokyo (Haneda-2010) and Central Japan (Chubu-2005) Airport Projects.

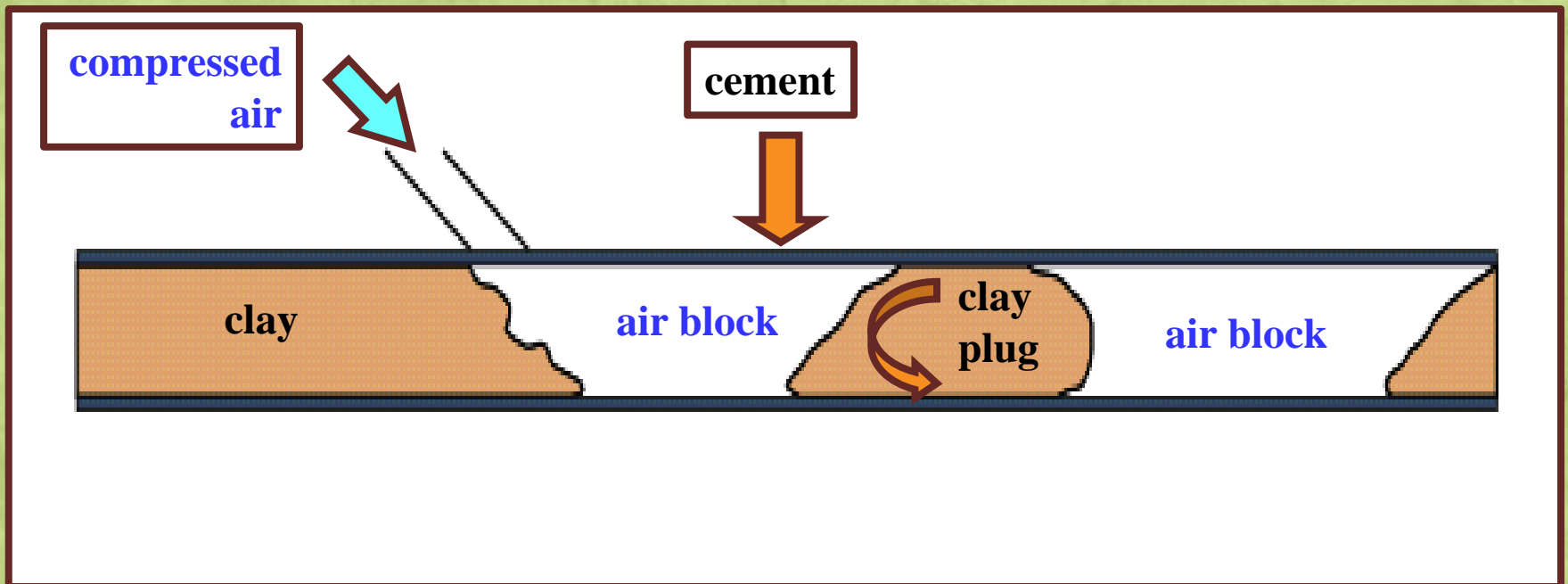
Kitazume, 2016 CRC Press, ISBN 9781138029842 - CAT# K30201





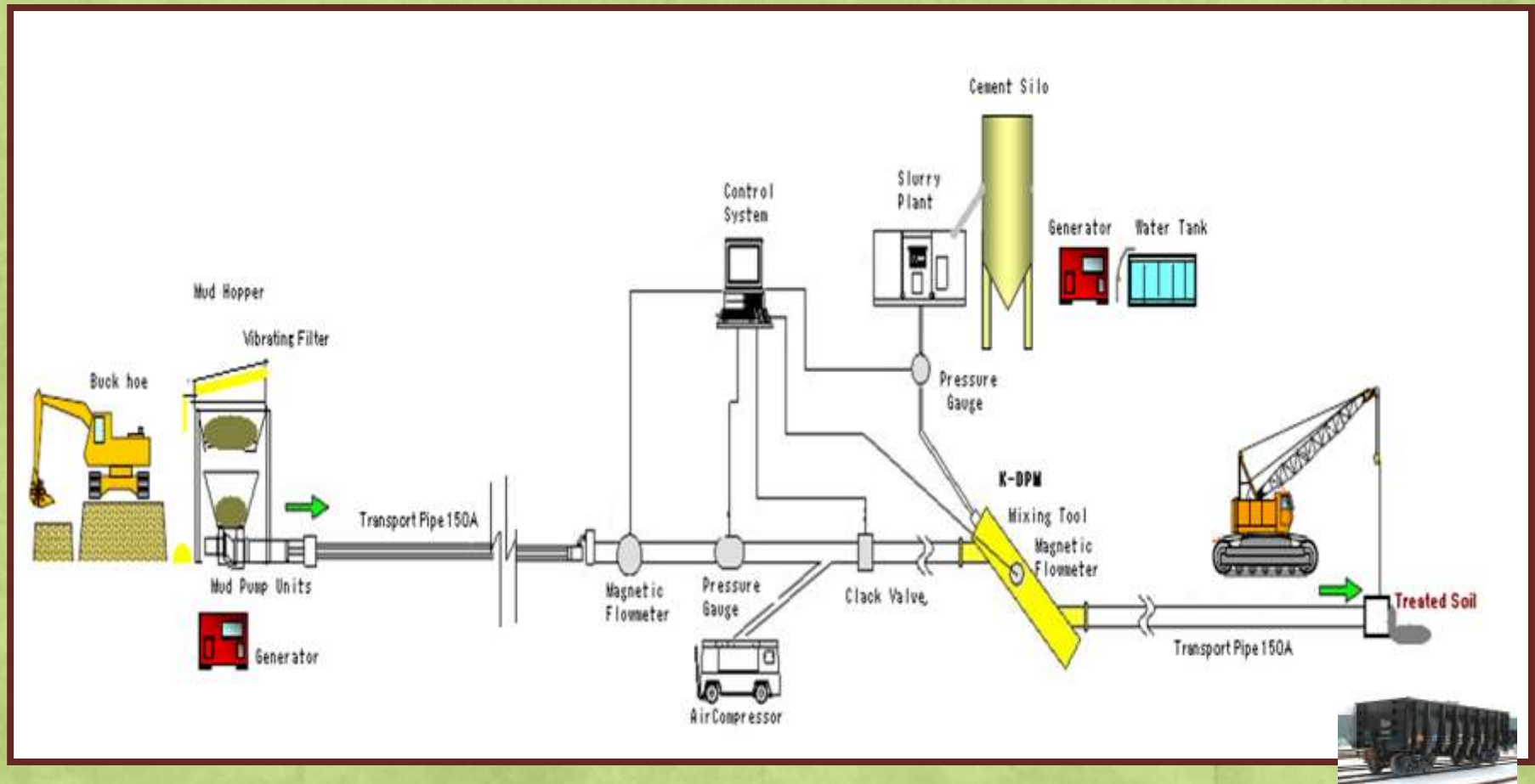
# Pneumatic Flow Tube Mechanism

"Soft sediment is broken into "plugs" by compressed air. Plugs reduce pipe surface friction easing flow. During transport cement and clay are mixed by the turbulent flow within the 'plug' ." - [Kitazume 2002](#)





# PFTM Process Flow



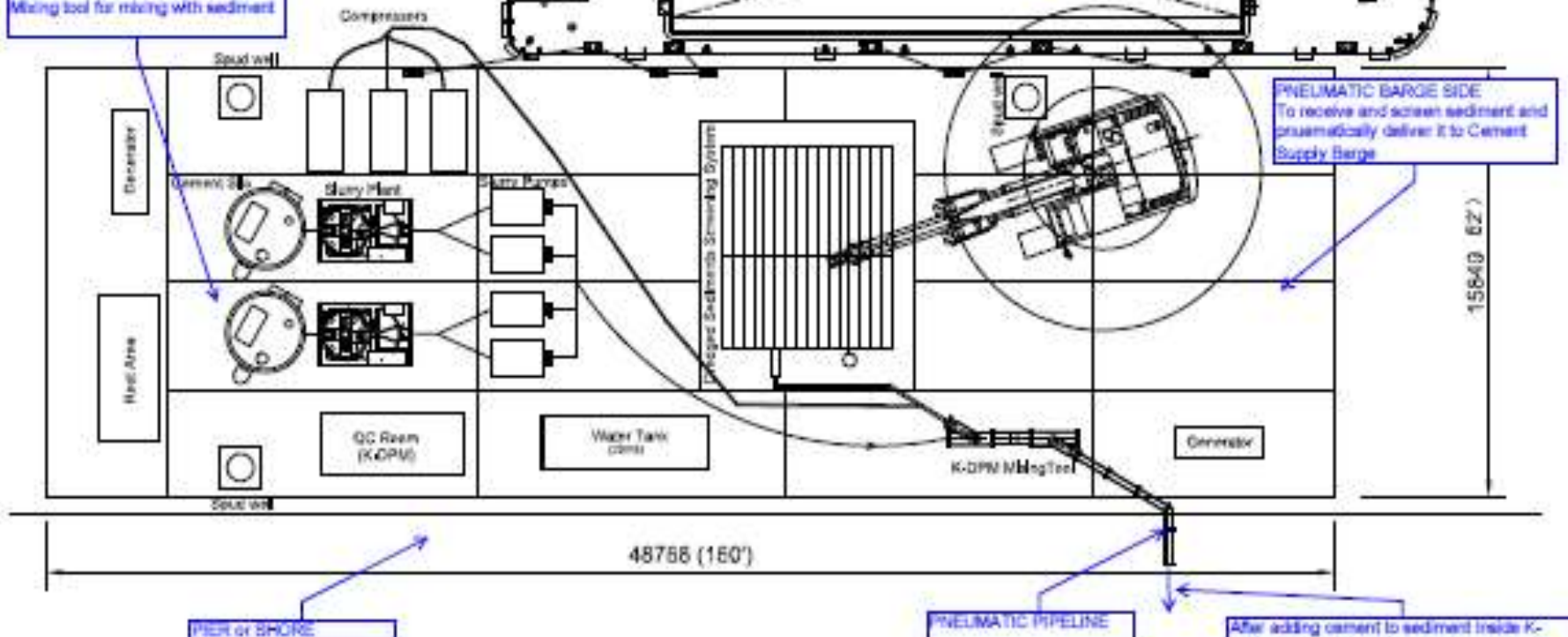


# TIPPING POINT

Resources Group, LLC

## CEMENT SUPPLY BARGE SIDE

To receive cement, produce cement slurry and send slurry to K-DPM Mixing tool for mixing with sediment



**JAFEC USA, Inc.**  
GEOTECHNICAL CONSTRUCTORS

## TUBE MIXING EQUIPMENT LAYOUT ON BARGES (DRAFT)

(Proprietary and Confidential Information of JAFEC/ACM) - Do not copy or release without written permission from JAFEC USA, Inc.

DESIGNED BY	DATE	PROJECT NO.	REVISION
DRAWN BY	DATE	PROJECT NO.	REVISION
CHECKED BY	DATE	PROJECT NO.	REVISION
APPROVED BY	DATE	PROJECT NO.	REVISION







# PFTM Applications



## ☐ Environmental

- Solidification and Stabilization of contaminated soft sediments
- Rapid and efficient utilization of stored CDF materials
- Landfill covers
- Brownfields (Structural caps)
- Coastal Restoration

## ☐ Structural

- Bulkhead backfills
- Reduction of lateral earth pressures (berm construction for flood control)
- Trench filling
- Structural and non-structural fills
- Shallow improvement
- Liquefaction mitigation and improvement of dynamic response





# Off-shore PFTM Airport Construction

Construction of a man-made island  
for Central Japan International  
Airport by the Pneumatic Tube  
Mixing method



Prof. M. Kitazume  
Tokyo Institute of Technology  
Port and Airport Research Institute



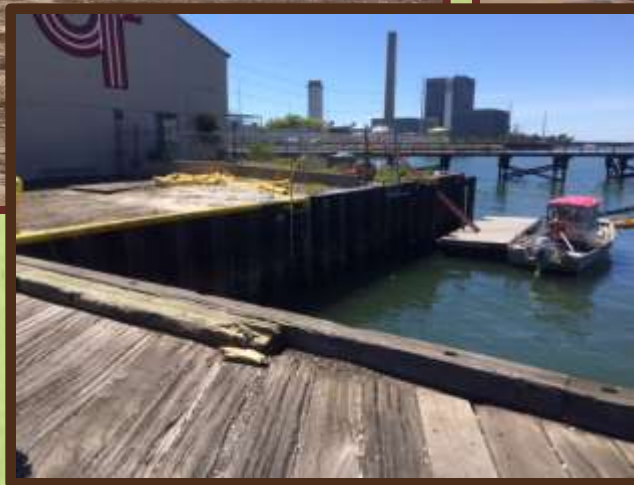


Location of  
TPRG New  
Haven  
Facility

Figure 1. Site Location Map

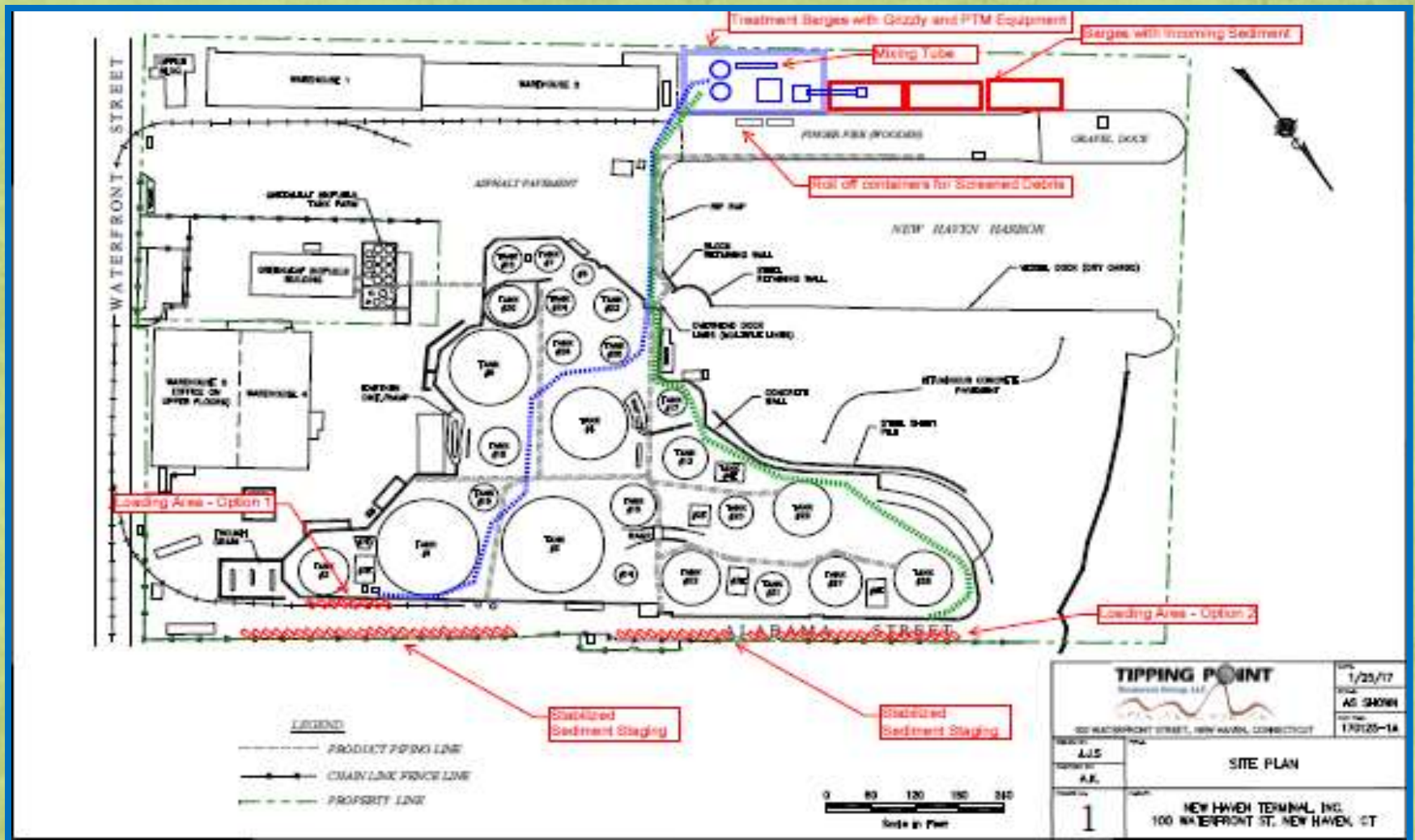


# Connecticut Regional Manufacturing Processing Facility Dock View to Adjacent Direct Rail





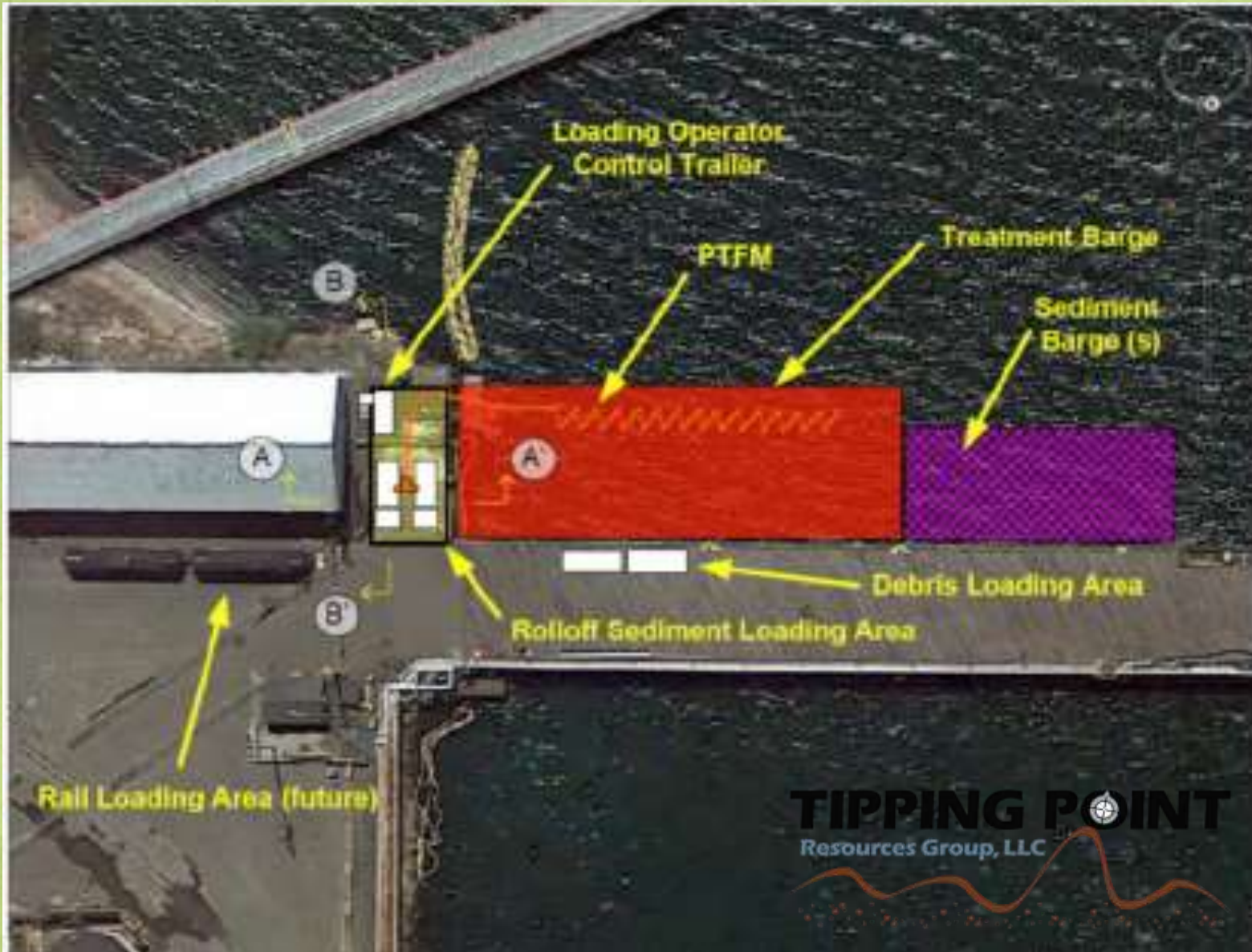
# PFTM Pump to Roll-off Truck Option





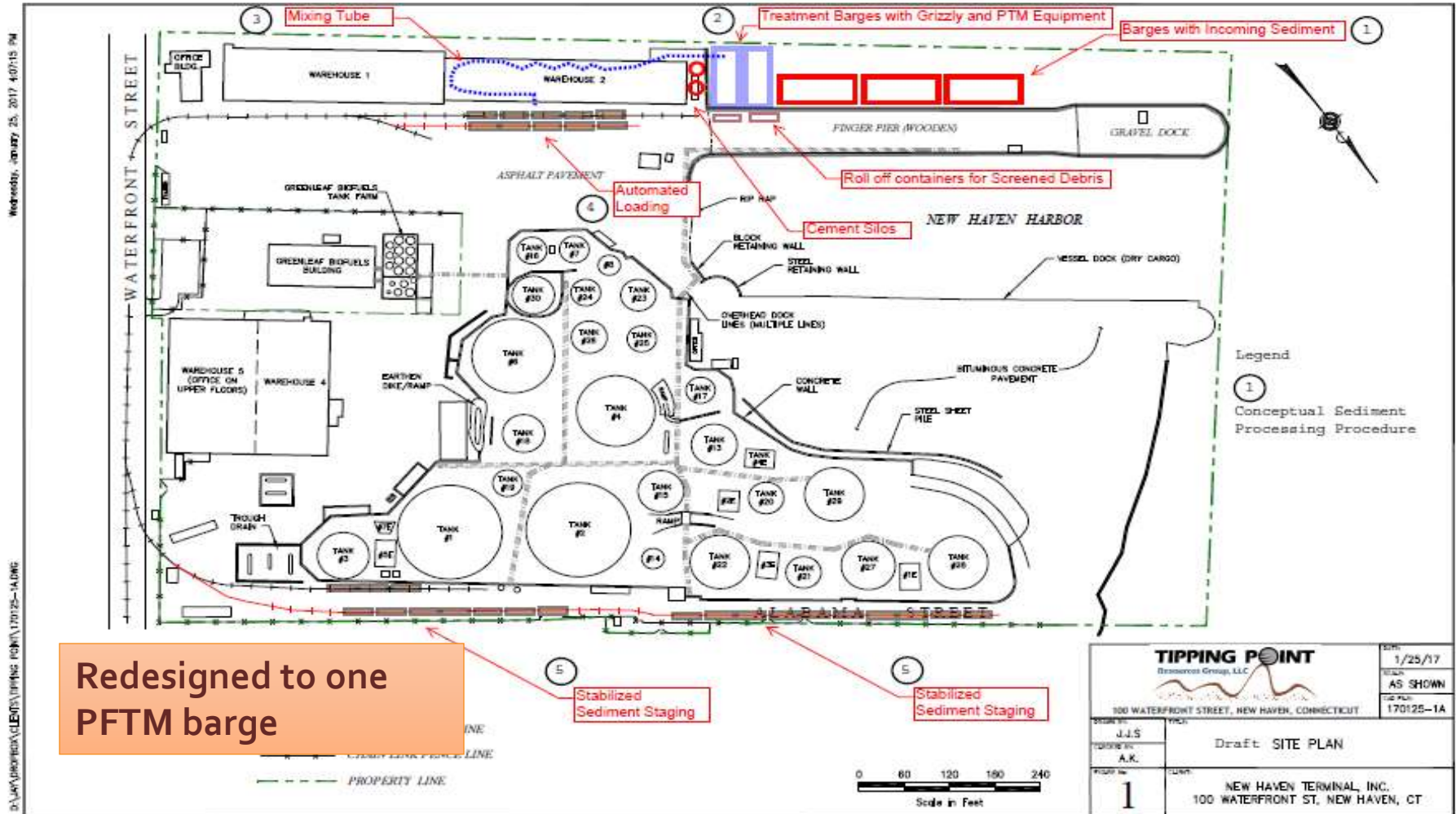
## Evolution # 2

Processing Directly into Secondary Barge and Excavate and Truck/Rail



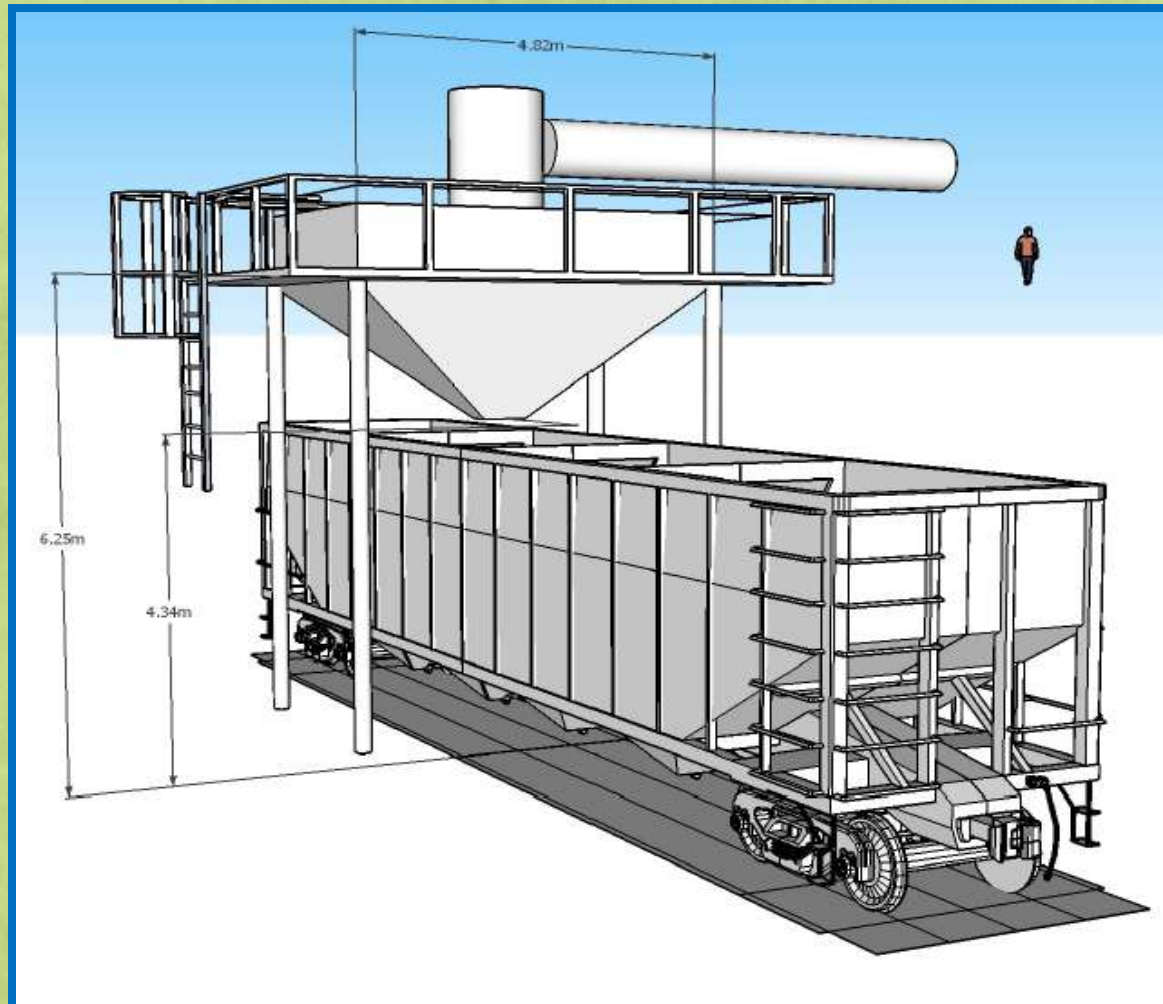


# Waterfront Barge Access, PFTM Processing, Rail Loading / Staging, Transport to Brownfield Placement Site -





# PFTM Gondola Rail Car Loader









# Sustainable Green Development of a Connecticut Brownfield



*Upland Beneficial Use of Sediment that Drives Sustainable Economic Growth*

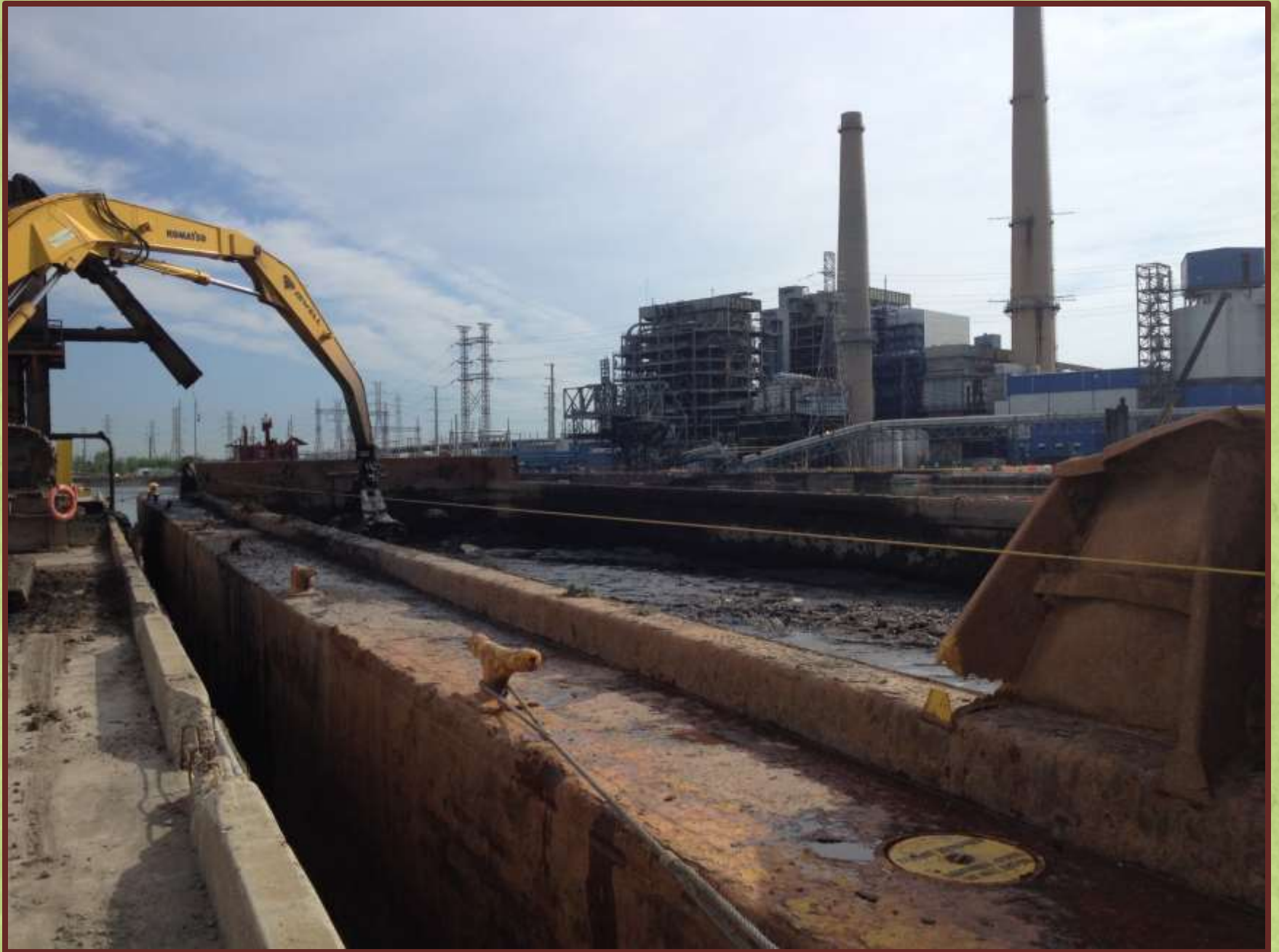


# PFTM New Jersey US Demonstration

## Project Sponsors / Background

- ❑ Site: Kearny, NJ
- ❑ Project Title: Utilization of PFTM for processing and stabilization of contaminated soft sediments
- ❑ Sponsor: NJDOT
- ❑ Research team:
  - Rutgers/CAIT
  - Tokyo Institute of Technology
  - JAFEC-USA
  - Others
- ❑ The total amount of material processed during the deployment was 3833+ m<sup>3</sup>
- ❑ Total of 26 working days, with an average production rate of 165 m<sup>3</sup> per day











# Pneumatic Flow Tube Mixer and Transport Pipe / Flexibility Pipe and Materials Handling Design



Small footprint  
Pump long distances (1-3 km)



# PFTM Delivery + Stabilized PDM



*Upland Beneficial Use of Sediment that Drives Sustainable Economic Growth*











# PFTM Campaign Analytical Test Results

- All samples were analyzed for total constituent concentrations (mass of contaminant/mass of sample) and for leachate concentration via the SPLP procedure at a NJ certified Laboratory. Analyses included Base Neutral+15, TAL Metals, Pesticides and PCBs (Arochlor)
- SPLP leachate analysis results indicated no detectable mass of any Base Neutrals (PAHs, Pesticides or PCBs) and the only metal found in the leachate was arsenic. The concentrations of Arsenic in the leachate from the raw sediment for the 8% mix were 14.8 and 15.9  $\mu\text{g/L}$  and 3.97, 3.47 and 3.97  $\mu\text{g/L}$  in the stabilized material indicating that 75% of potential leaching arsenic was mitigated by the stabilization procedure
- Chemical analyses indicate that the material is suitable for placement at the site



# NJ PFTM Campaign Conclusions

The results of the laboratory and field experimental program demonstrate the utility of PFTM as a rapid and efficient method for stabilization and placement of soft sediments dredged from the NY/NJ Harbor. The material stabilized using PFTM had uniform geotechnical properties and acceptable chemical properties resulting in a high potential for beneficial use



# Progress:



- CT DEEP Solid Waste Demonstration Project Permit
- Brownfield permitting
- JAFEC USA/Japan Design
  - Barge / re-design of grizzly/shaker system
- Rail infrastructure /sidings /transportation logistics
  - Including brownfield off loading at terminus
- Source material / Demonstration – Life Cycle (Engineering, Economics, Beneficial Use, Integrated Program (s) Analysis) / comfort zone.....
- Regional markets (CT,RI, MA, NH, ME)
- Education/outreach
- R&D / dosing + cement replacements



# Beneficial Use Programs / Treatment and Materials Science

- Sedi.Port.Sil
- CEAMas
- SETARMS
- SEDILAB
- EcoSed
- GeDSET
- Sedimateriaux Approach
- New York/New Jersey Harbor Sediment Decontamination Program (USEPA/NJDOT/BNL)
  - Changing perception of sediments as a waste to a sustainable resource



