NEW BEDFORD HARBOR SUPERFUND SITE DREDGING – ACCURACY COUNTS

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BOTTOM LINE UP FRONT:
WHY DOES ACCURACY COUNT?

Table 1
Implications of Dredging Accuracy on Volume and Cost

Upper Harbor Subtidal Area (Acres)	Upper Harbor Subtidal Area (ft^2)	Overdredge (ft)	Overdredge Volume (ft^3)	Overdredge Volume (CY)	$/CY	Cost
115	5,009,000	0.1	500,900	19,000	$500	$9,500,000
		0.2	1,001,800	37,000		$18,500,000
		0.5	2,504,500	93,000		$46,500,000
		1	5,009,000	186,000		$93,000,000

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OUTLINE

- Introduction
  - Site Background
  - Contaminant Distribution
- Dredging and Sediment Disposal – Two approaches
  - Dredging with hydraulic transport, sediment processing and offsite disposal
  - Dredging with placement in Confined Aquatic Disposal (CAD) Cell
- Dredging concerns and requirements
  - Estuarine and Tidal Environment
  - Residuals management
  - Accuracy
  - Production

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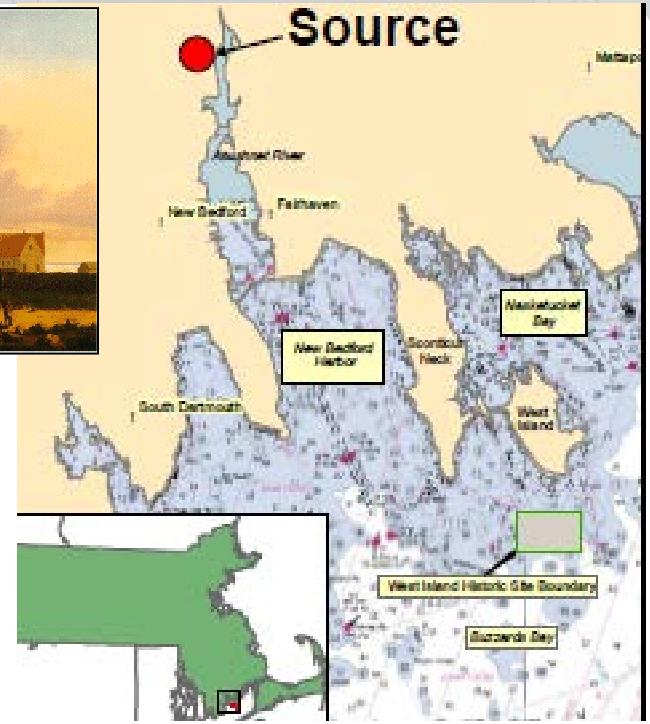
Site Location

- Tidal estuary and good natural harbor
- Established as a port in the 1600's



New Bedford Harbor

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Site Location

- Superfund site covers 18,000 acres
- Hurricane Barrier is 4,500 feet long, 20 feet above mean sea level in height, and has 150 foot- wide entrance
- Site is divided into upper, lower and outer harbor

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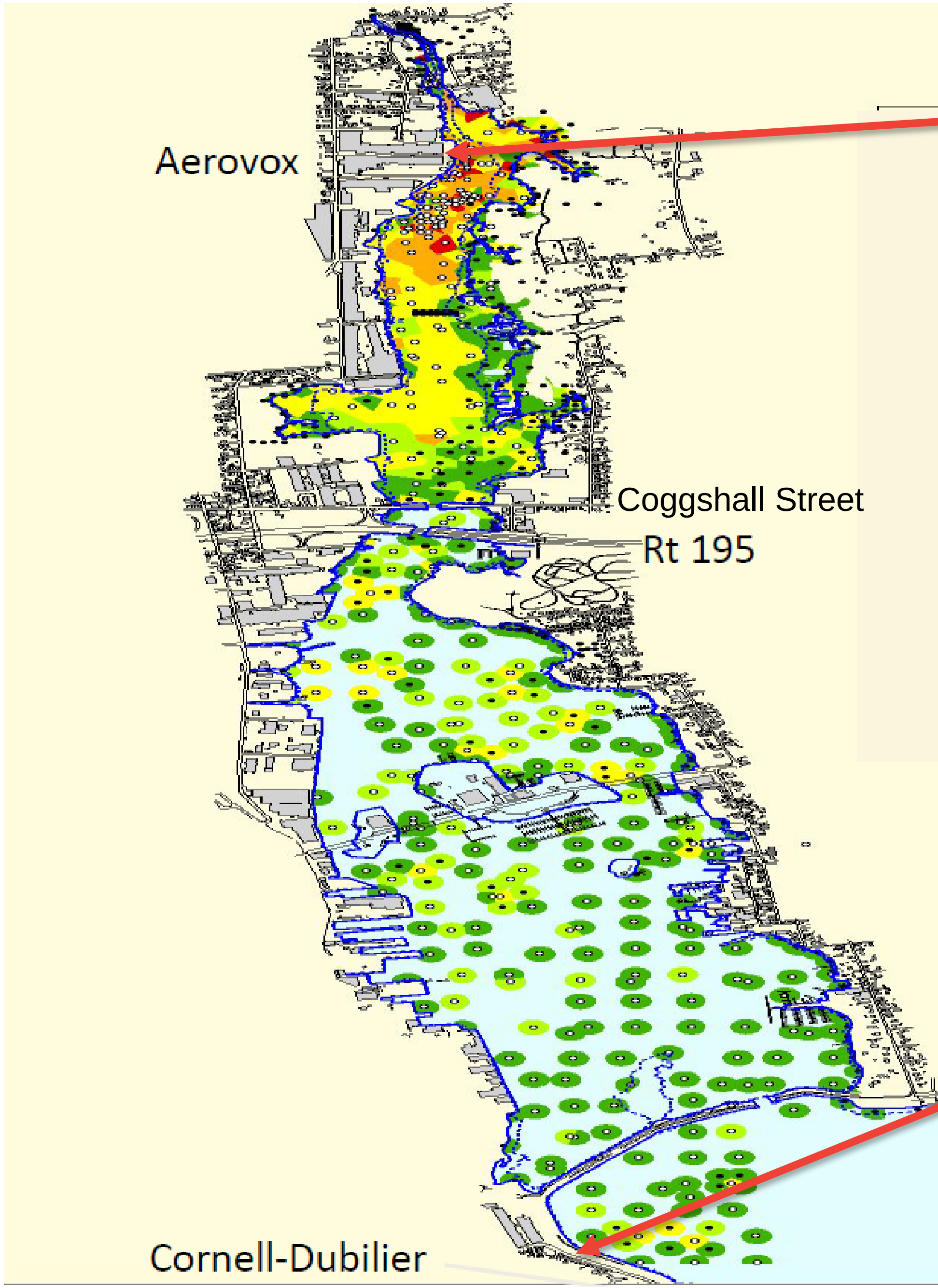

Aerovox Site

Main Source of PCBs in Upper Harbor

PCB gradient is north to south

- > 4,000 ppm sediment PCBs
- 501 to 4,000 ppm
- 51 to 500 ppm
- 10 to 50 ppm
- <10 ppm

Cornell-Dubilier

Source of PCBs in Outer Harbor

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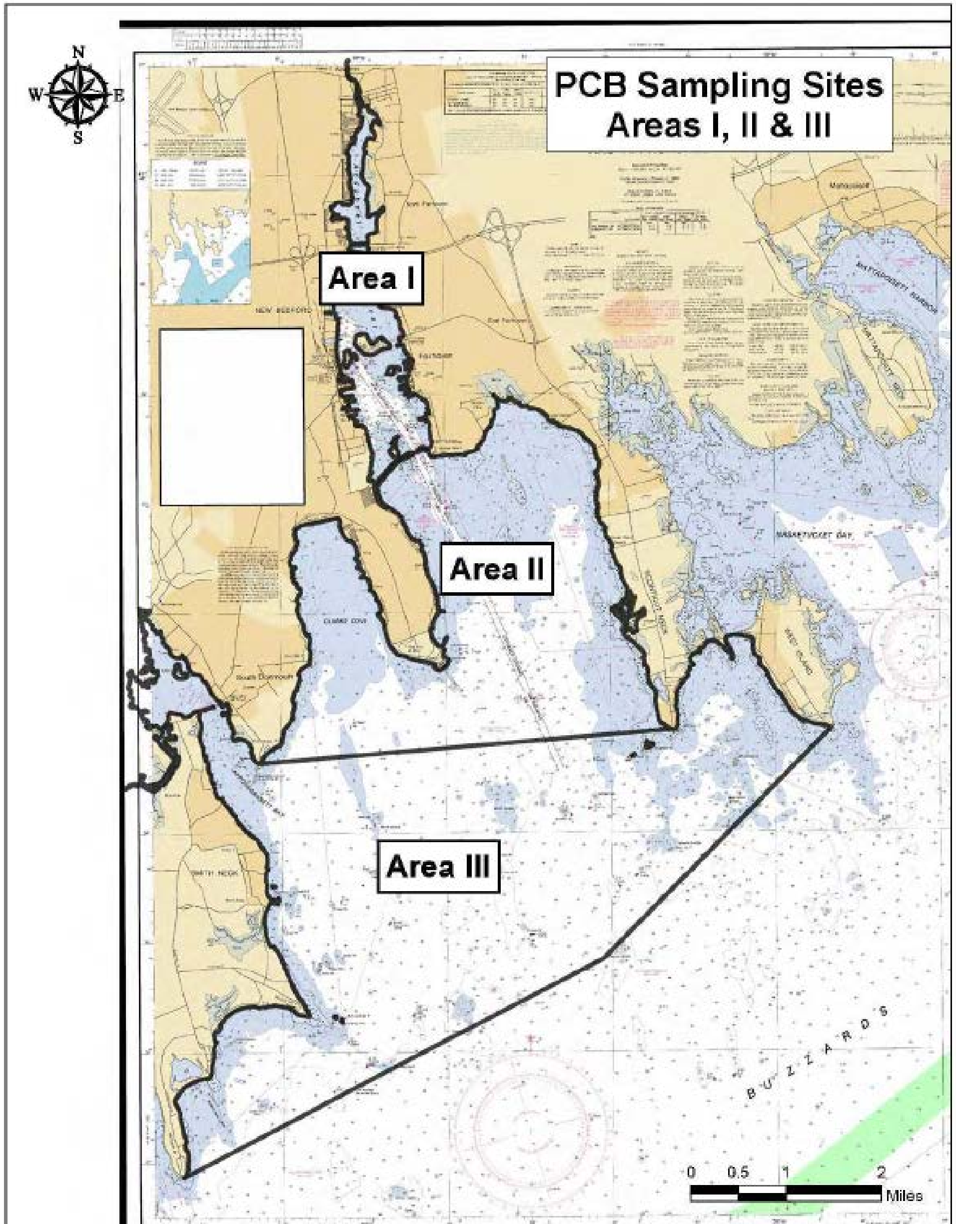

Figure 1 Fish Closure Areas I to III

Why are we dredging?

1) Reduce health risks due to the consumption of seafood.
2) Reduce health risks due to contact with PCB-contaminated shoreline sediment.
3) improve the quality of the harbor's highly degraded marine ecosystem.

Three state sanctioned fishing closure areas:

Area I – Closed to all fishing.
Area II – Closed to taking of lobster, eel, flounder, scup, and tautog.
Area III – Closed to lobstering

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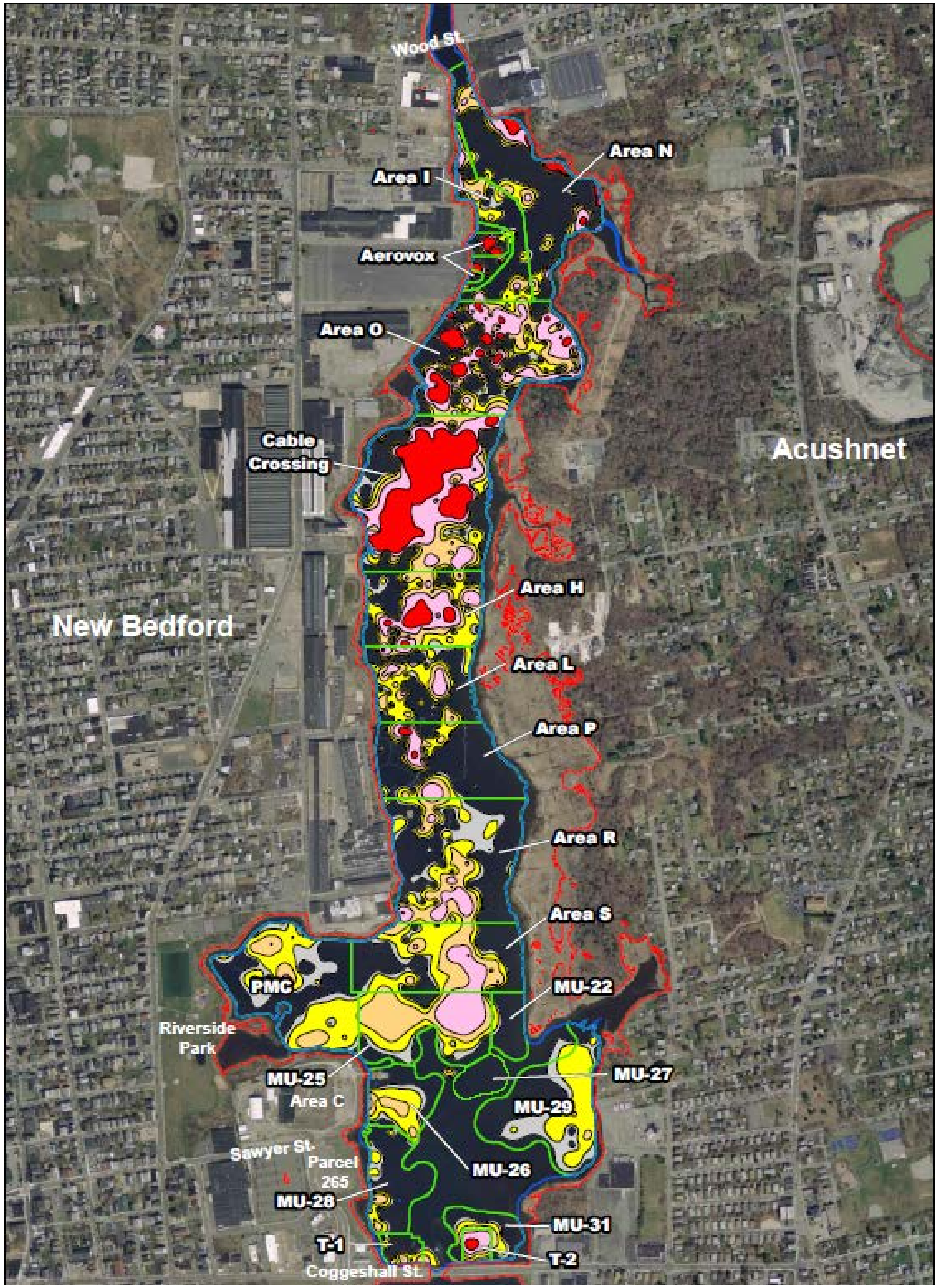
TWO APPROACHES FOR DREDGING AND SEDIMENT DISPOSAL

- For higher contamination areas in the upper harbor the process is: mechanically dredge, screen material, slurry sediment, transport hydraulically by pipe, de-sand, de-water, and transport by rail to a TSCA landfill in Michigan.

- For lower contamination areas primarily in the lower harbor the process is: mechanically dredge, load into a scow and place into a CAD Cell.



Upper Harbor Dredging 2004-2017

- ~410,000 cubic yards (in situ) off site to date
- ~600,000 cubic yards (in situ) remaining
- 40,000 cubic yards (in situ) CAD Cell disposal from MU-25 & 28

Concentration Interval (ppm)

- > 500
- 200 - 500
- 100 - 200
- 50 - 100
- 30 - 50
- < 30

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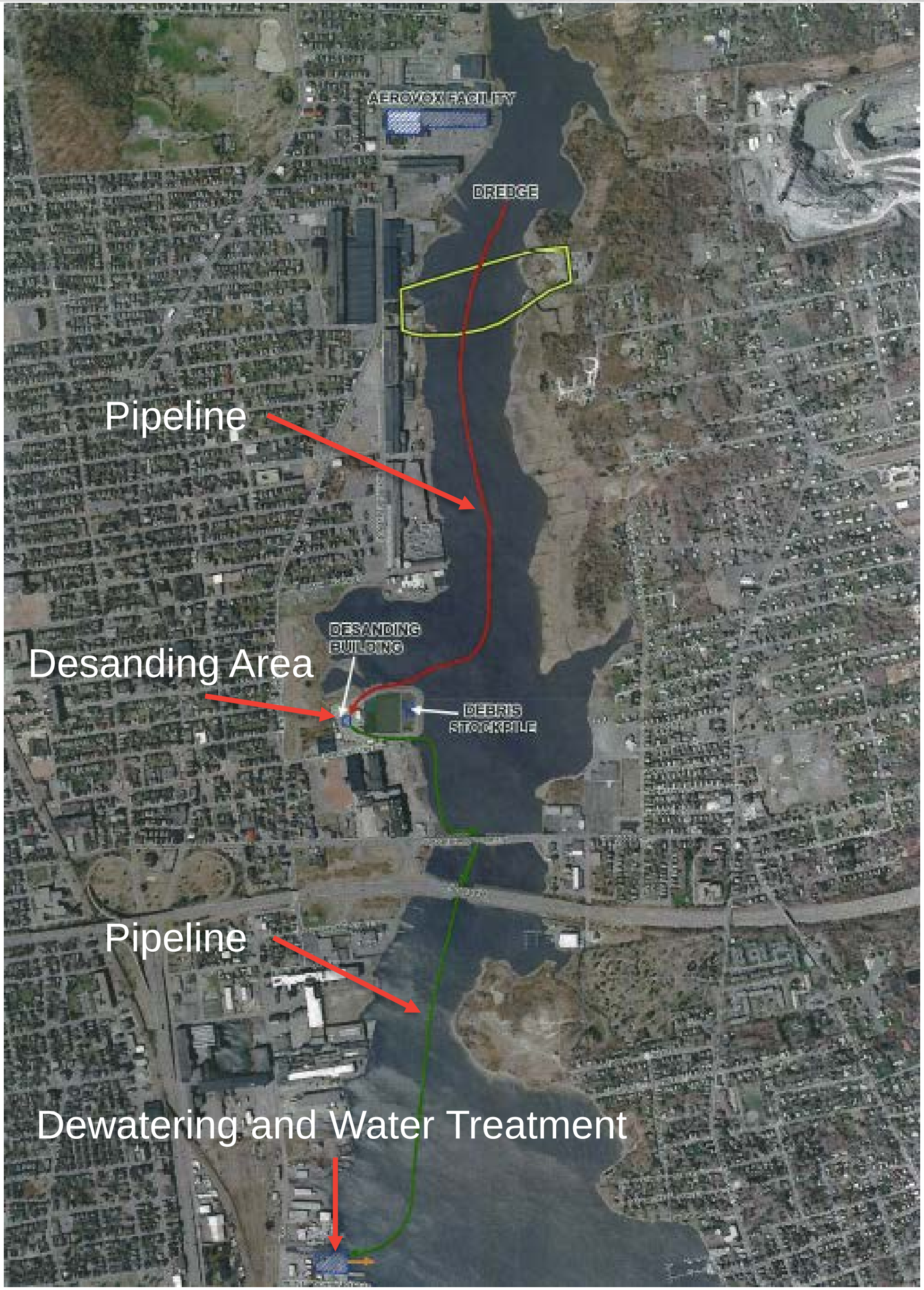
Upper Harbor Layout



Legend

Piping

- Desanded Sediment Slurry
- Dredged Sediment
- N-Star Buried Cable Perimeter
- Building

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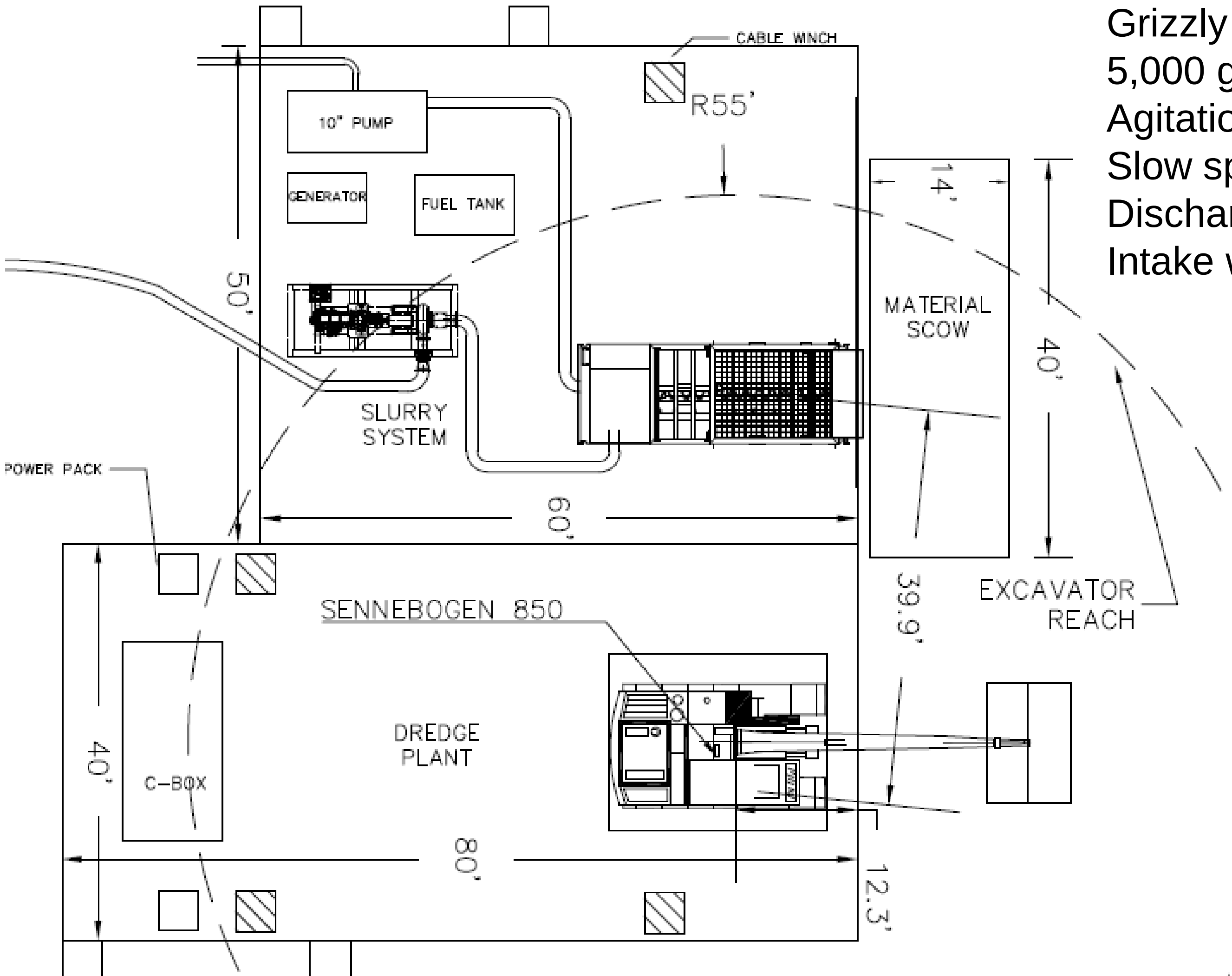
Hybrid System Layout with Dredge Plant and Slurry System



- Grizzly screen
- 5,000 gal tank
- Agitation jets
- Slow speed auger
- Discharge dredge slurry pump
- Intake with rock box

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Mechanical Dredge with Hydraulic Transport “hybrid system” during water calibration

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Sediment Processing – Desanding

Total Clean System Operating in Area C

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Sediment Processing – Dewatering

Gravity Thickener

Filter Presses

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Sediment Processing – Loadout by Rail

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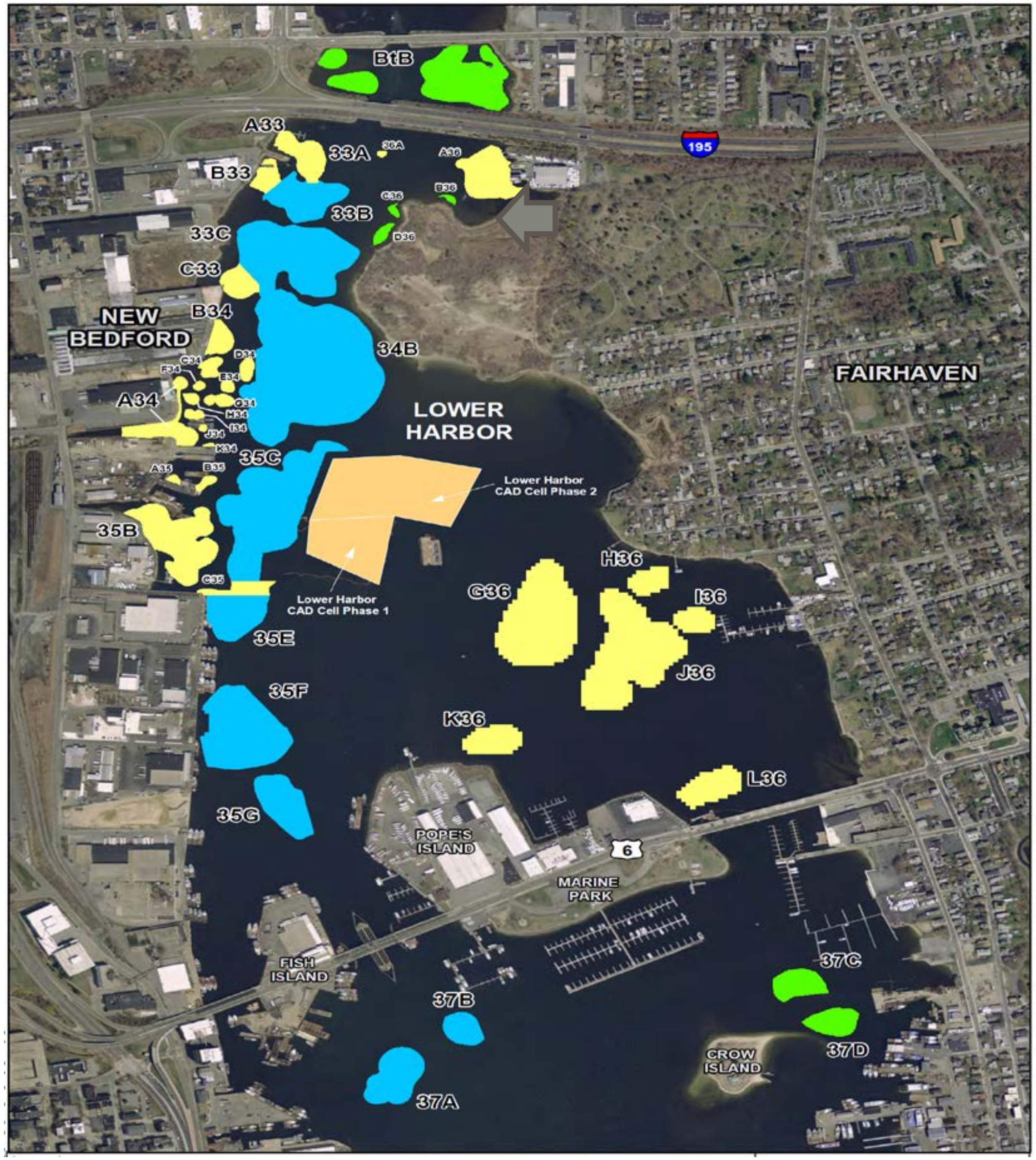
Water Treatment

Bag Filters and Sand Filters

Activated Carbon Filters

Lower Harbor Dredge Areas with CAD Cell Disposal



- Areas completed in 2016 ~60,000 cubic yards
- Areas to be completed in 2017-18 ~138,000 cubic yards
- Green TBD ~15,000 cubic yards

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Transload of material from small scow to split hull dump scow

DREDGING REQUIREMENTS

Testing 3.5 CY Level Close Bucket

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+/- 0.5 inch
Variance on sand
test bed

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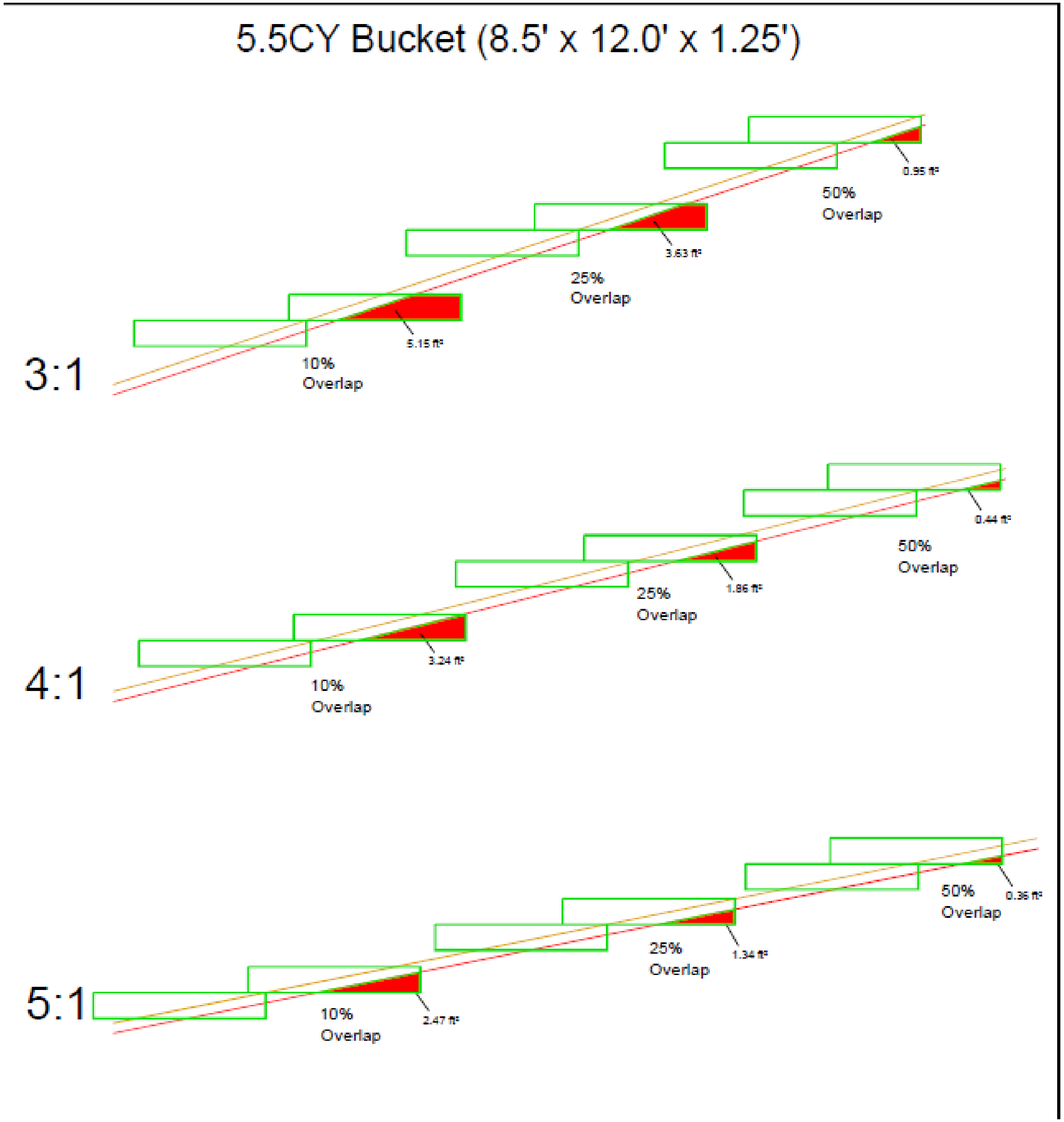
Balancing over-dredge with production rate



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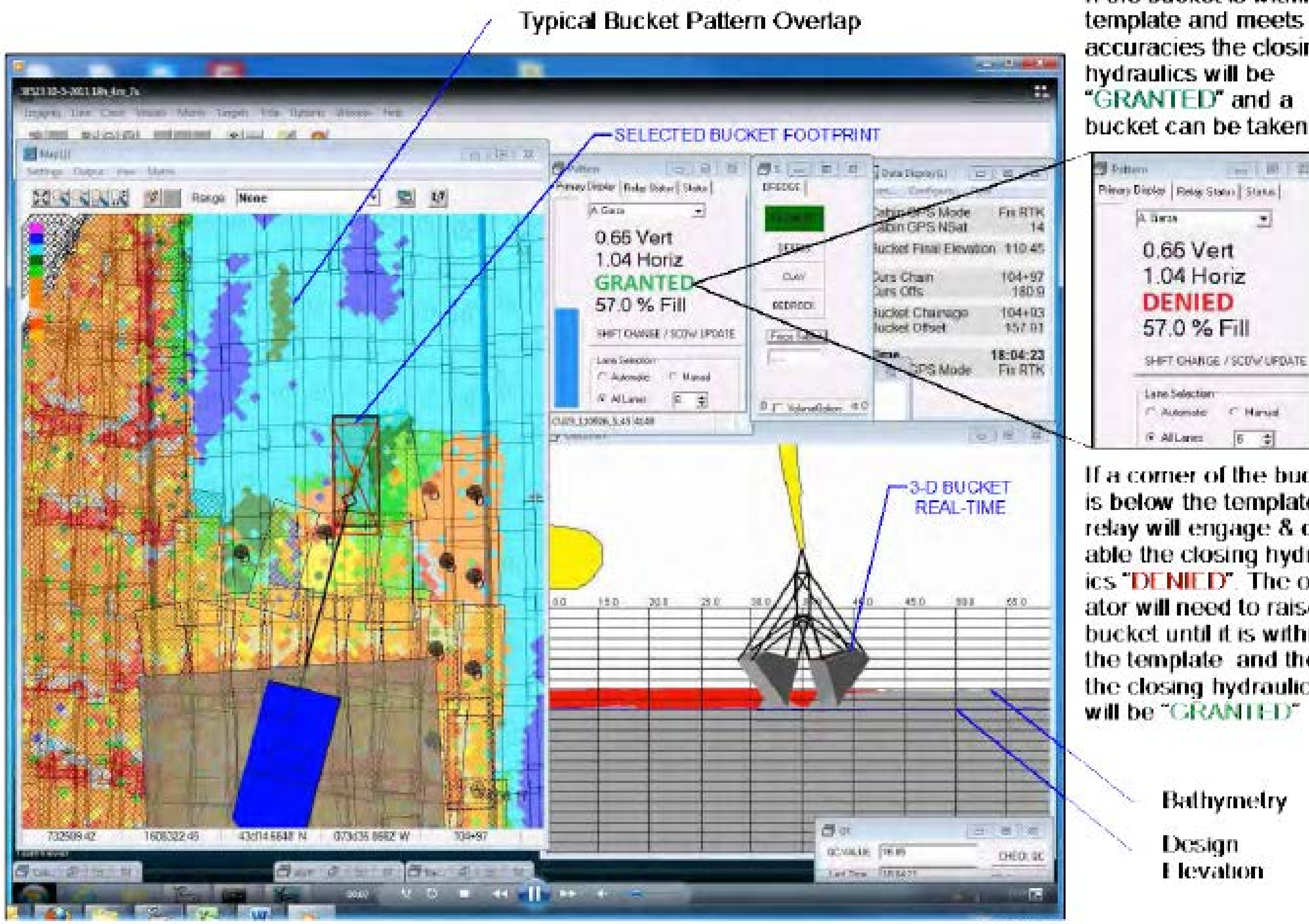
State of the Art Dredge Monitoring and Positioning Systems



If the bucket is within the template and meets the accuracies the closing hydraulics will be "GRANTED" and a bucket can be taken

If a corner of the bucket is below the template the relay will engage & disable the closing hydraulics "DENIED". The operator will need to raise the bucket until it is within the template and then the closing hydraulics will be "GRANTED"

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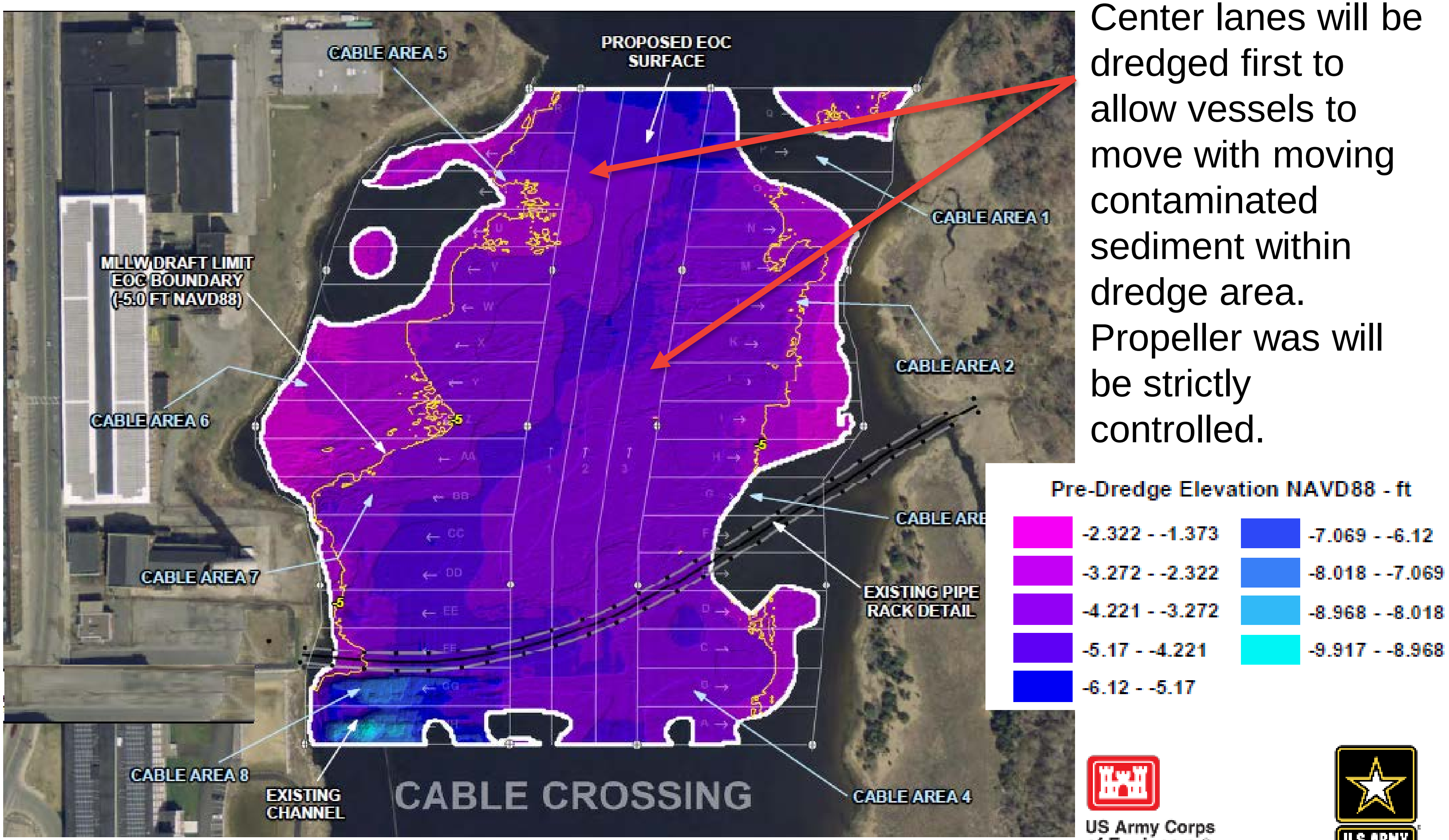
Upper Harbor Dredge Area Lane Design with Bathymetry

- Shallow water depths require working with tides and two dredges.



Center lanes will be dredged first to allow vessels to move with moving contaminated sediment within dredge area. Propeller was will be strictly controlled.

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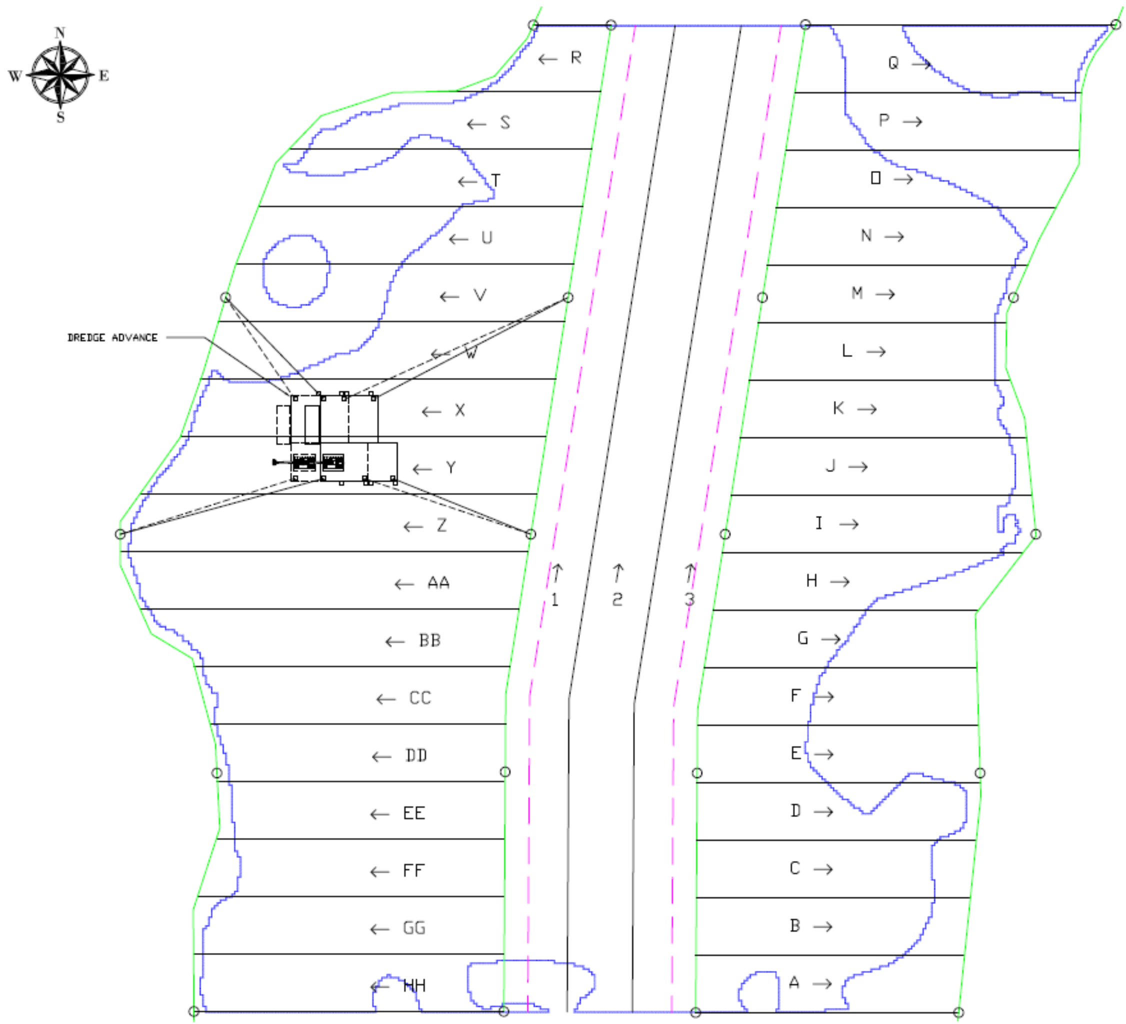
Dredge lanes with cable transport shown



LEGEND

- ZONE BOUNDARY
- 150' CHANNEL
- CABLE GUIDE LINES
- SHEETPILE LOCATIONS

NOTES:
1) SHEETPILE LOCATIONS ARE SAMPLES TO SHOW APPROXIMATE 250' SPACING. SHEETPILE LOCATIONS WILL BE ADJUSTED IN THE FIELD.
2) DREDGING WILL ALTERNATE BETWEEN CENTER CHANNEL (S-N LANES) AND LETTERED LANES BASED ON TIDE.
3) EAST-WEST DREDGE LANES ARE 60' WIDE.

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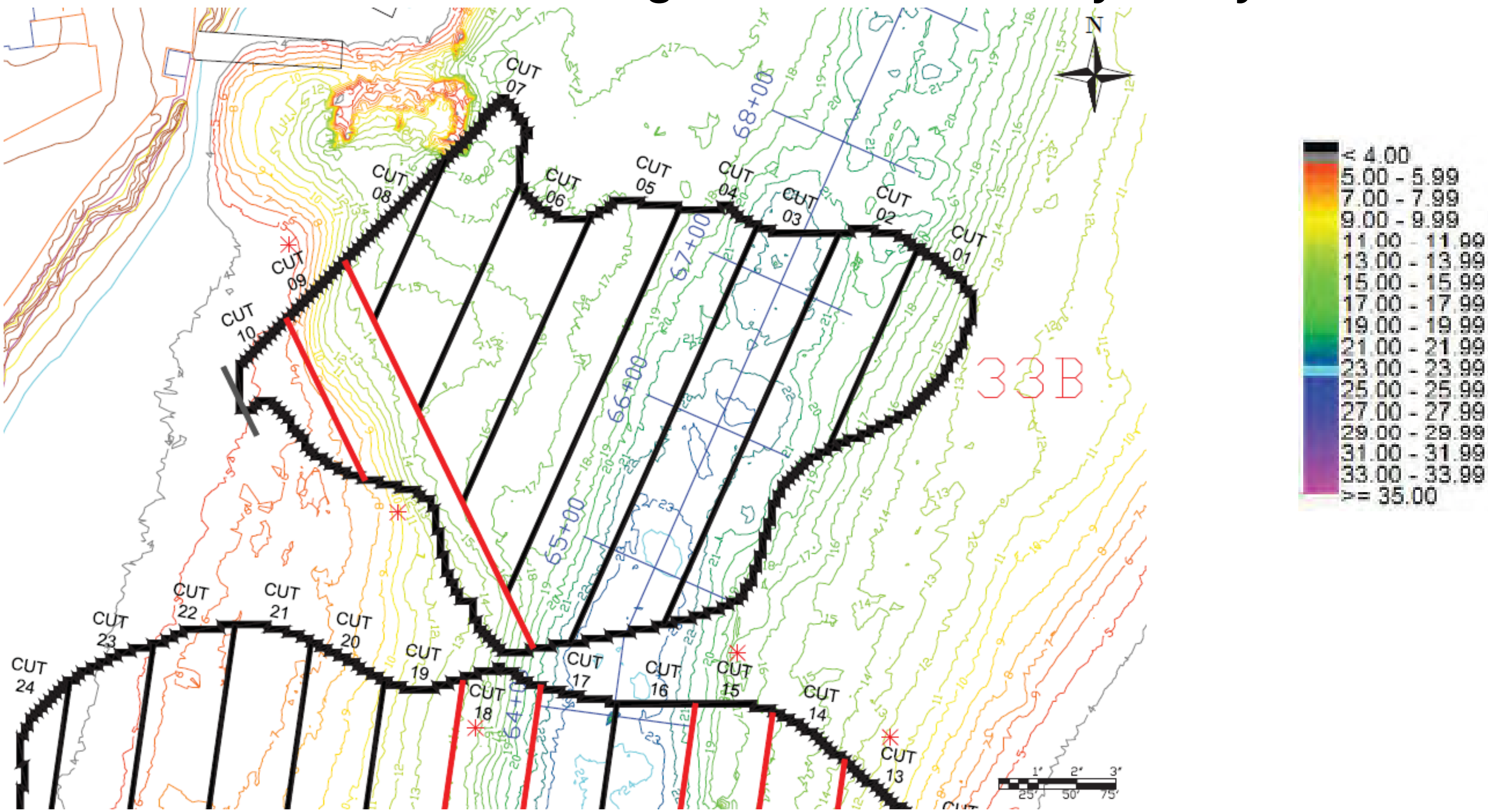
Lower Harbor Dredge Area with Bathymetry



Each dredge area will be setup with 50' cut lanes that run parallel to the natural slope.

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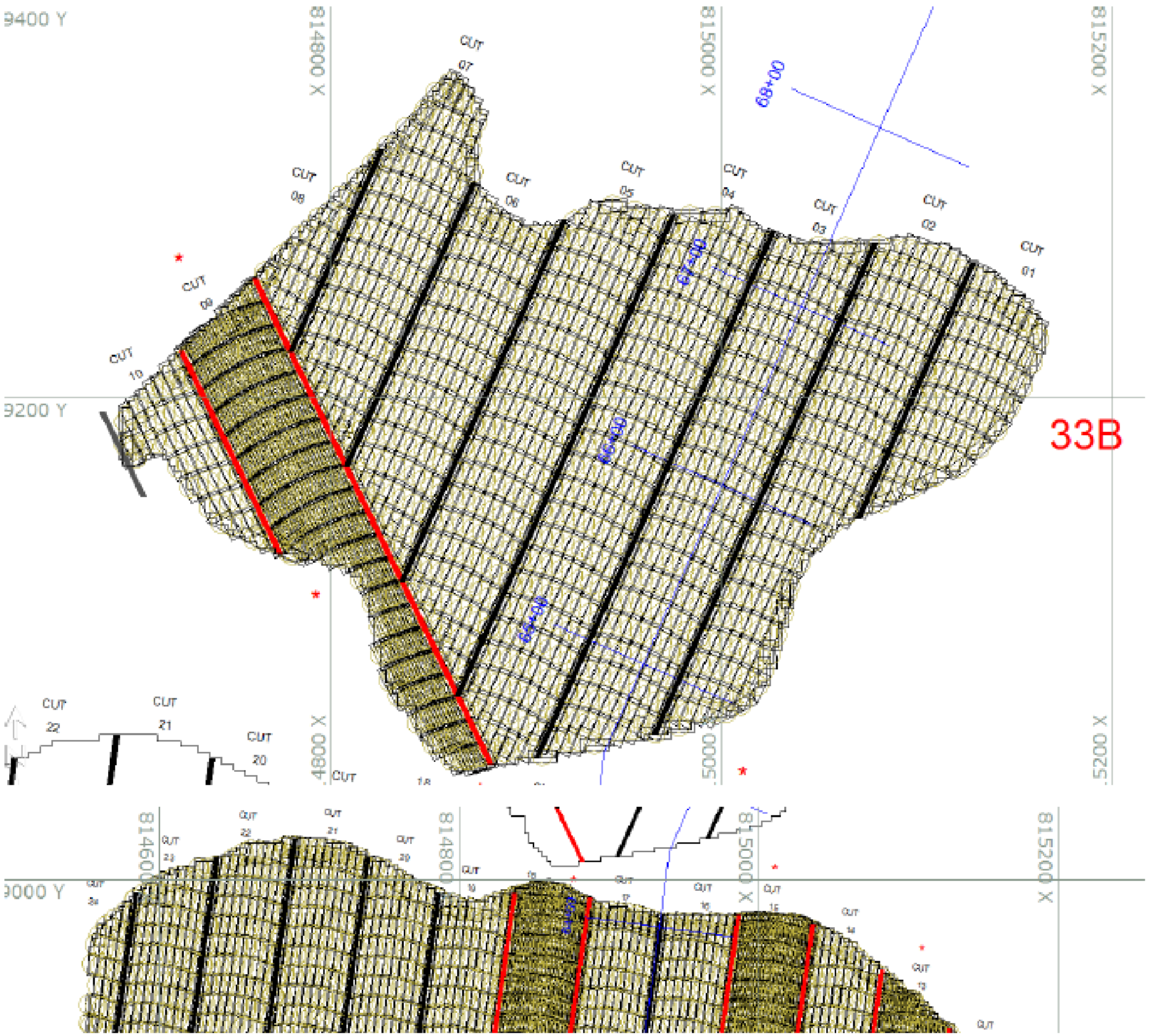
Dredge areas with Bucket Patterns



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Example Error Budget

Komatsu PC490XX MH w/ XX Boom, Stick, Bucket Configuration

Component	Component Length (ft)	Measurement	Measurement Error	Position Error, Vertical (ft)	Position Error, Horizontal (ft)	Notes
RTK GPS	*static*	*RTK GPS*	*.020 ft + 1 ppm H / .050 ft + 1ppm V*	*0.050*	*0.020*	
Boom, Stick	*56*	*Heading GPS*	*0.050°*	*0.000*	*0.049*	*maximum reach estimate*
GPS Roll		*Inclinometer*	*0.085°*			
GPS Pitch		*Inclinometer*	*0.085°*			
Boom	*33.2*	*Inclinometer*	*0.085°*	*0.049*	*0.009*	*Assume 10° inclination*
Stick	*25.7*	*Inclinometer*	*0.085°*	*0.033*	*0.019*	*Assume 30° declination*
Bucket Pitch		*Inclinometer*	*0.085°*			
Bucket Roll		*Inclinometer*	*0.085°*			
Bucket Rotate		*Rotation Sensor*	*0.085°*			
Total (ft.)				**0.132**	**0.097**	
Allowable 2"V & 3"H (ft.)				**0.167**	**0.250**	

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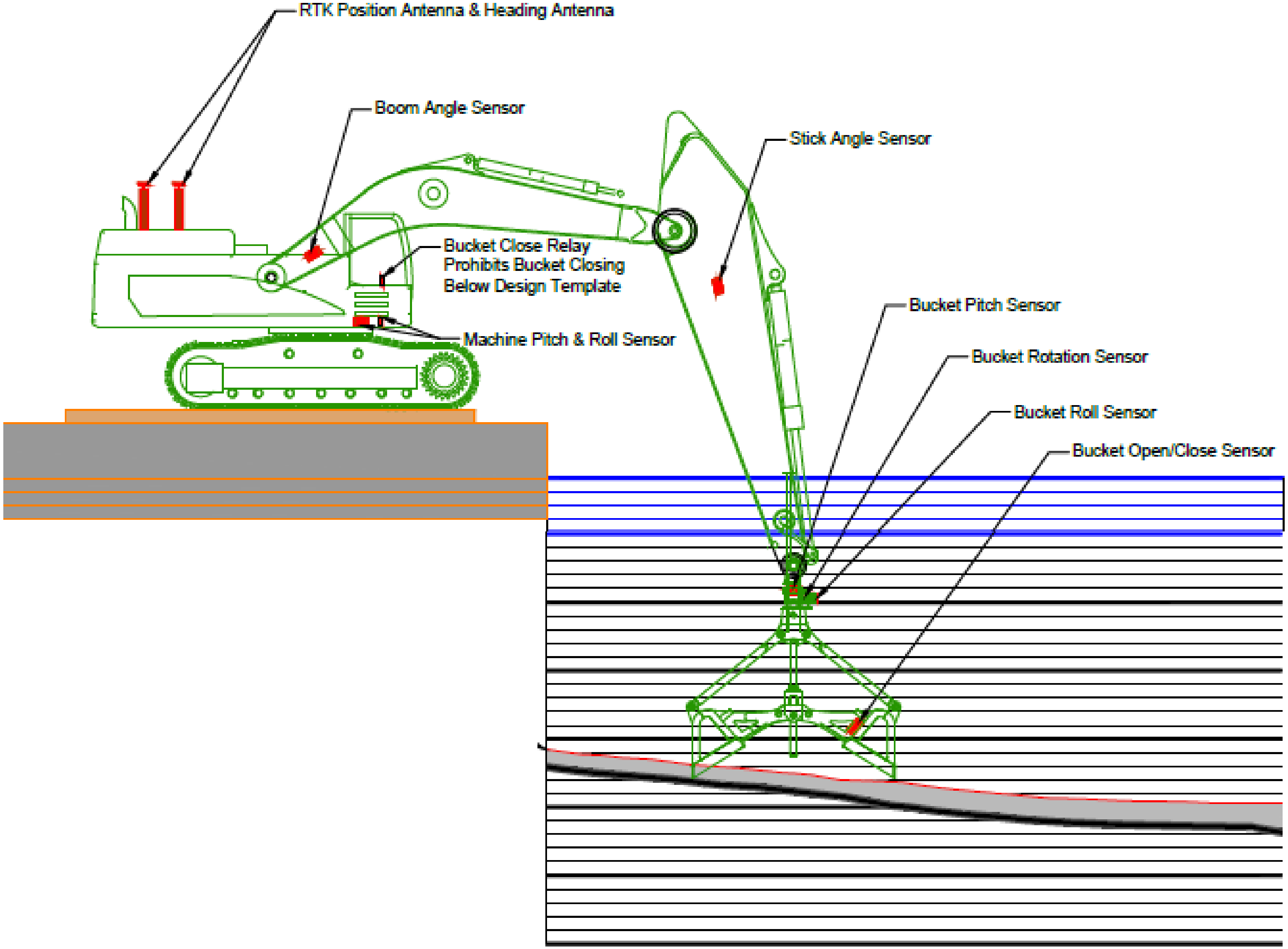

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SUMMARY:

- Sediment remediation at New Bedford Harbor Superfund Site is a high cost operation.
- Optimization is key
  - Manage residuals (lane design, bucket design, bucket overlap, propeller wash, working the tides)
  - Build in accuracy
  - Plan and maximize production rates

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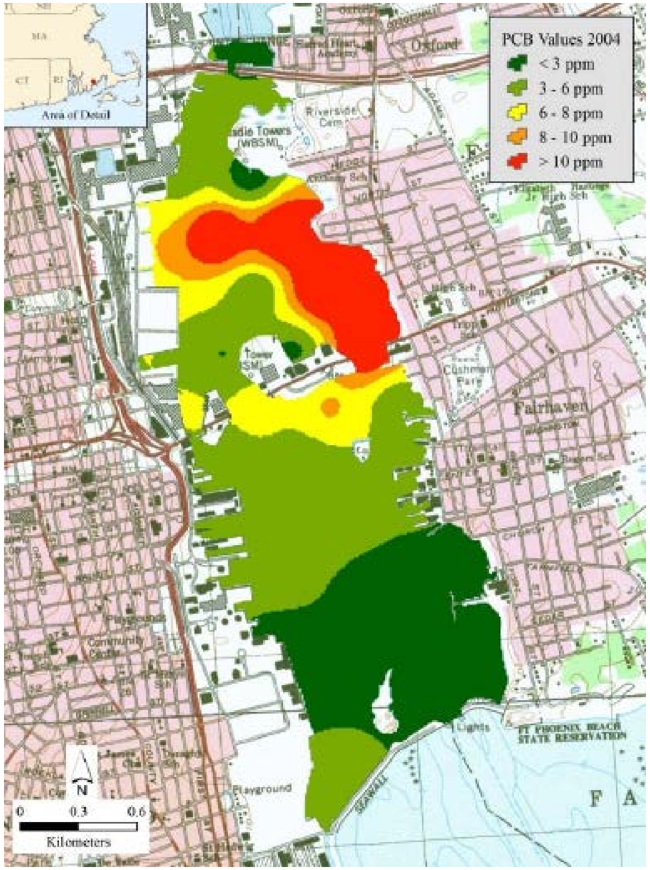
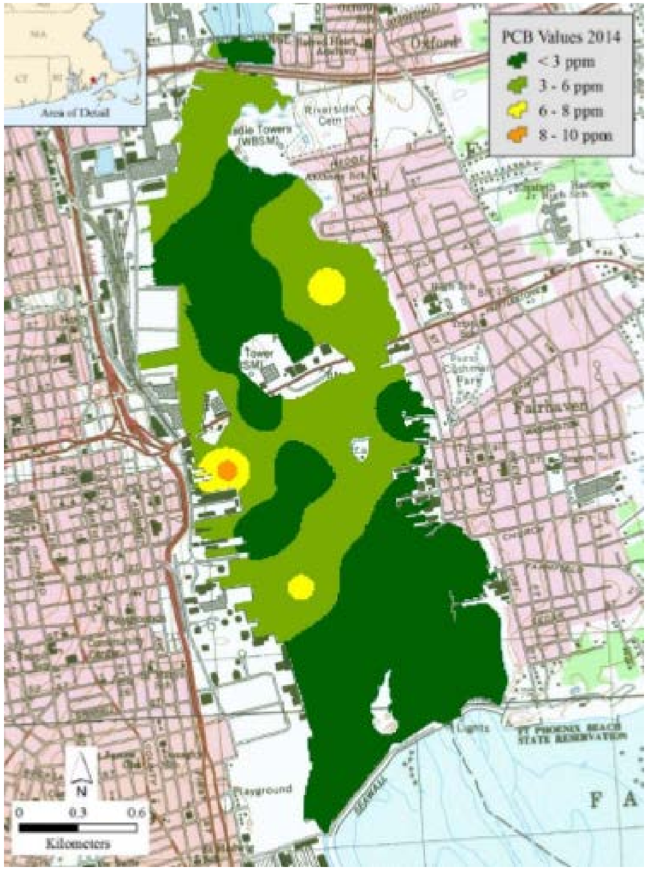
Surficial PCBs in Sediment

2004



2004 Average
NOAA 18 PCB =5.1 ppm

2014



2014 Average
NOAA 18 PCB = 2.8 ppm

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QUESTIONS?