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The Use of a Thin-Layer Cap to Manage Hg and PCB Contaminated Sediments in Peninsula Harbour, Ontario, Canada

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Environment Canada
Sediment Remediation Unit

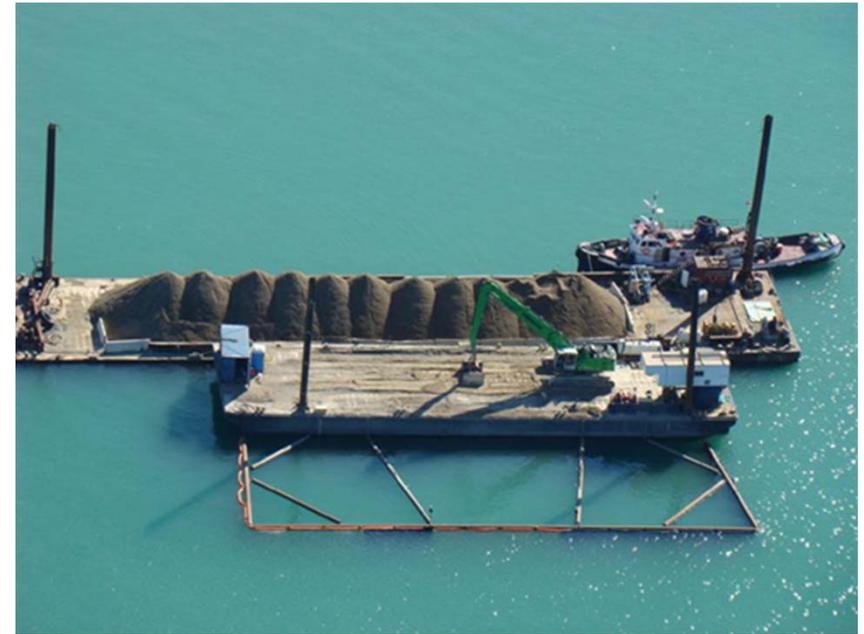
June 16, 2014 - Toronto, ON



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Outline

- 1. Engineering Design**
- 2. Procurement**
- 3. Implementation**
- 4. Lessons Learned**
- 5. Post Construction Monitoring**



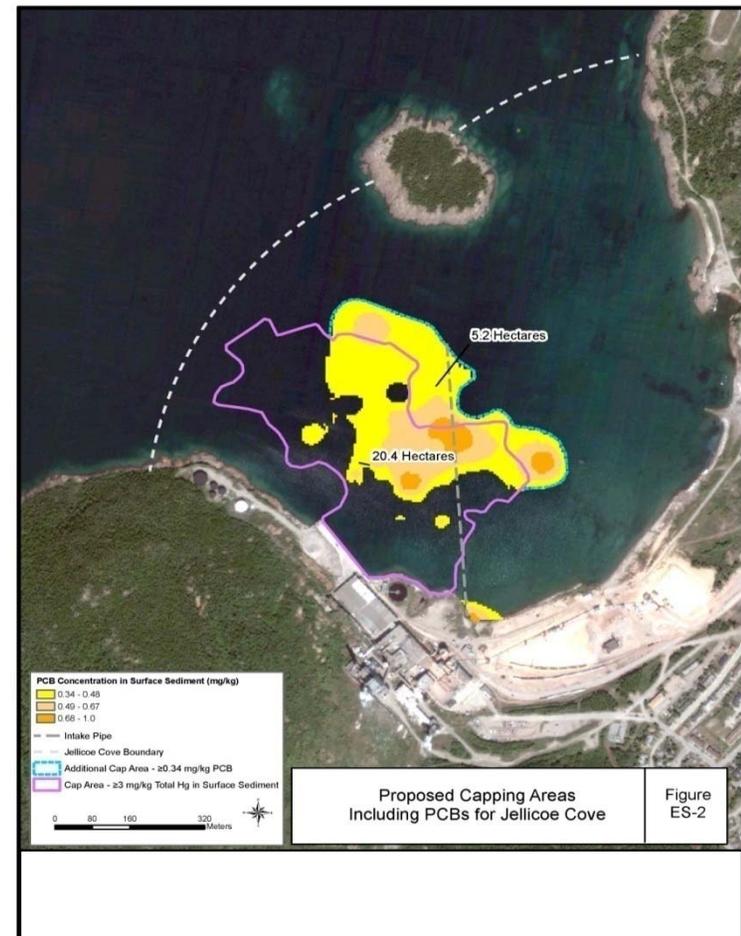
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Peninsula Harbour AOC

- COCs: Mercury and PCBs
- Source: historical pulp mill and Chlor-Alkali plant activities
- Sediment Management Area: 250,000 m² (25 ha or 50 football fields)
- Hg Management Target: 3 ppm
- PCB Management Target: 0.34 ppm



Engineering Design

Sand Gradation

	Medium sand	Coarse sand
Size	% passing	% passing
25 mm	100	100
12 mm	100	90-100
#10 sieve-2 mm	50-80	20-45
#40 sieve-0.425mm	10-40	0-10
#100 sieve-0.15 mm	<10	<10
#200 sieve-0.075 mm	<6	<6
Uniformity coefficient	<8	<8
Plasticity (fine fraction)	non-plastic	non-plastic
D50 mm	0.5	2.25
Specific Gravity	>2.64	>2.64



Engineering Design

Sand Specification - Chemical

- Chemical properties of the sand to meet CCME's Interim Freshwater Sediment Quality Guidelines except for Chromium and Copper
- Cr and Cu levels were revised to local background levels as these levels are naturally high in this area. (Cr \leq 50 ppm; Cu \leq 90 ppm)



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Engineering Design - Sand

Staging and Borrow Areas in Relation to TLC Site



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NOTES:

1. FOR LIMIT OF MEDIUM SAND CAP, REFER TO DRAWING NO. M-08.
2. MEASURE CAP THICKNESS TO CENTERLINE OF WATER-BOUND ZONE.
3. CAP THICKNESS INDICATED REPRESENTS A NOMINAL THICKNESS.
4. CAP THICKNESS REQUIREMENTS:
 - 1. MINIMUM THICKNESS = 15 cm
 - 2. MINIMUM CAP THICKNESS = 15 cm
 - 3. MINIMUM CAP THICKNESS = 30 cm

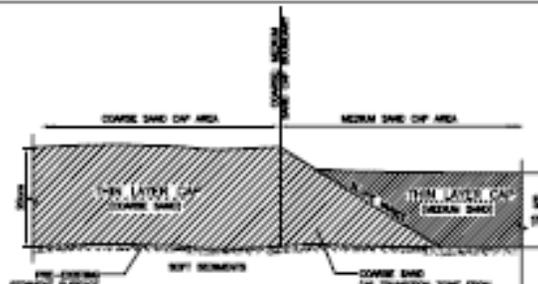
MEDIUM SAND CAP 1
SCALE: N.T.S. M-09



NOTES:

1. FOR LIMIT OF COARSE SAND CAP, REFER TO DRAWING NO. M-08.
2. MEASURE CAP THICKNESS TO CENTERLINE OF WATER-BOUND ZONE.
3. CAP THICKNESS INDICATED REPRESENTS A NOMINAL THICKNESS.
4. CAP THICKNESS REQUIREMENTS:
 - 1. MINIMUM THICKNESS = 15.0 cm
 - 2. MINIMUM CAP THICKNESS = 20 cm
 - 3. MINIMUM CAP THICKNESS = 27.5 cm

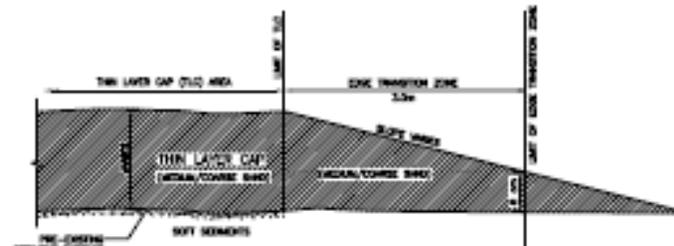
COARSE SAND CAP 2
SCALE: N.T.S. M-09



NOTES:

1. THIS DETAIL APPLIES TO THE TRANSITION FROM A COARSE TO MEDIUM SAND CAP.
2. DETAIL ASSUMES COARSE SAND IS PLACED FIRST.

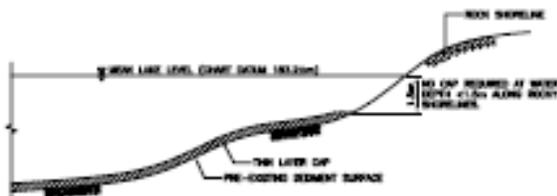
COARSE: MEDIUM SAND CAP TRANSITION 3
SCALE: N.T.S. M-09



NOTES:

1. THIS DETAIL APPLIES TO EDGE OF CAP AT LOCATIONS WHERE SOFT SEDIMENTS EXIST. IT DOES NOT APPLY TO EDGE OF CAP ALONG ROCKY SHORELINES.
2. CONSTRUCT CAP TO SPECIFIED THICKNESS TO LIMIT OF TLC SHOWS.
3. ALLOW CAP THICKNESS TO BE GRADUALLY INCREASED THROUGH TRANSITION ZONE AND CHANGE MINIMUM 5 cm SAND THICKNESS AT LIMIT OF EDGE TRANSITION ZONE.

EDGE OF CAP 4
SCALE: N.T.S. M-09



CAP ALONG SHORELINE 5
SCALE: N.T.S. M-09

Public Works and Government Services Canada
Autorité canadienne des services publics
Travaux publics et Services gouvernementaux Canada
Notice d'approbation de la plan
Approuvé en Ontario

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4	ISSUED FOR REVIEW	2019-05-04
3	ISSUED FOR PERMITS	2019-04-02
2	ISSUED FOR PERMITS	2019-03-14
1	ISSUED FOR PERMITS (A-10)	2018-11-05

revision	description	date
A	Issue for Review	2019-05-04
B	Issue for Permits	2019-04-02
C	Issue for Permits (A-10)	2018-11-05

City of Marathon and Ontario in site and surrounding lands the appropriate responsibility of all participants.

City of Marathon
MARATHON Ontario

PENINSULA HARBOUR
SEDIMENT REMEDIATION
Project No.
DETAILS: CAP

Drawn by	VM
Checked by	C.J.P.
Approved by	D.S.R.
Project Number	Project Number M-09
Issue Date	2009-10-27
Issue No.	R,024725.001
Issue To	M-10

Cap Transition Zones

Contracting

1. EC was the project lead and PWGSC was the contracting authority
2. Tendering vs. RFP methods of procurement were examined
3. Decided to go with an RFP based on performance criteria (i.e., RFP specified the performance criteria and it was up to bidders to come up with methodology to meet the performance criteria)
4. Bids evaluated by EC, MOE, AECOM and PWGSC



Contracting – Performance Criteria

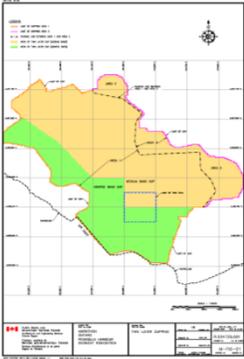
1. Cap area coverage
2. Cap thickness
3. Sand gradation
4. Sand chemistry
5. Turbidity
6. Water Chemistry – release of Hg and PCBs from contaminated sediment



Environmental Mitigation Measures

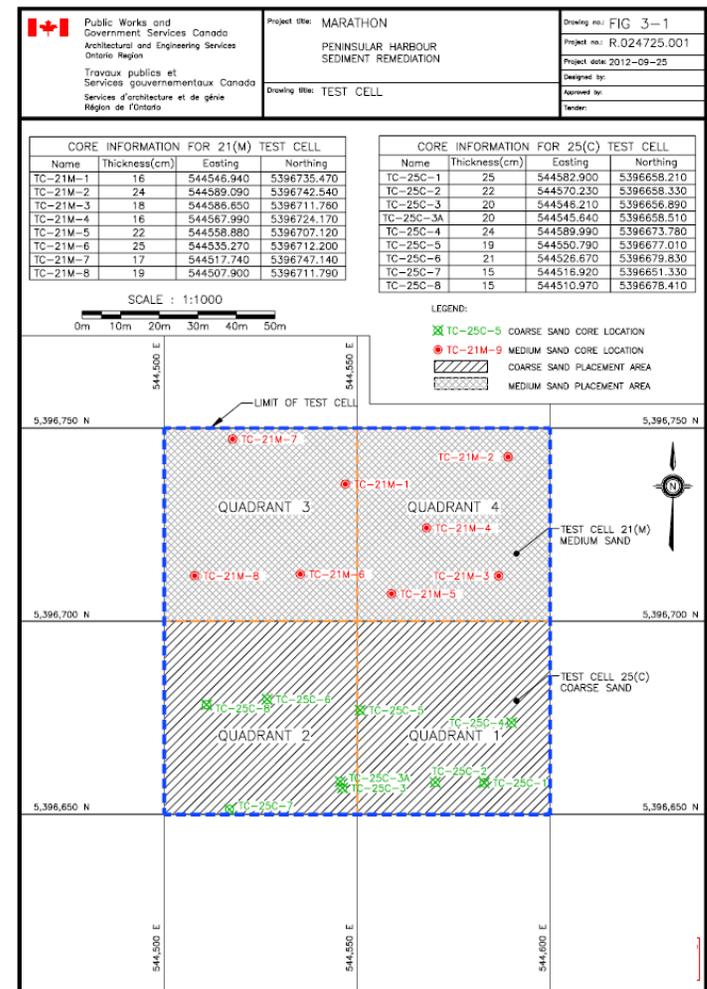
- Silt fence placed to prevent sand from entering water in the staging area
- Installed turbidity curtains to protect two nearshore habitat areas as per DFO/MNR advice
- Turbidity curtain box attached to the capping barge (bidder)





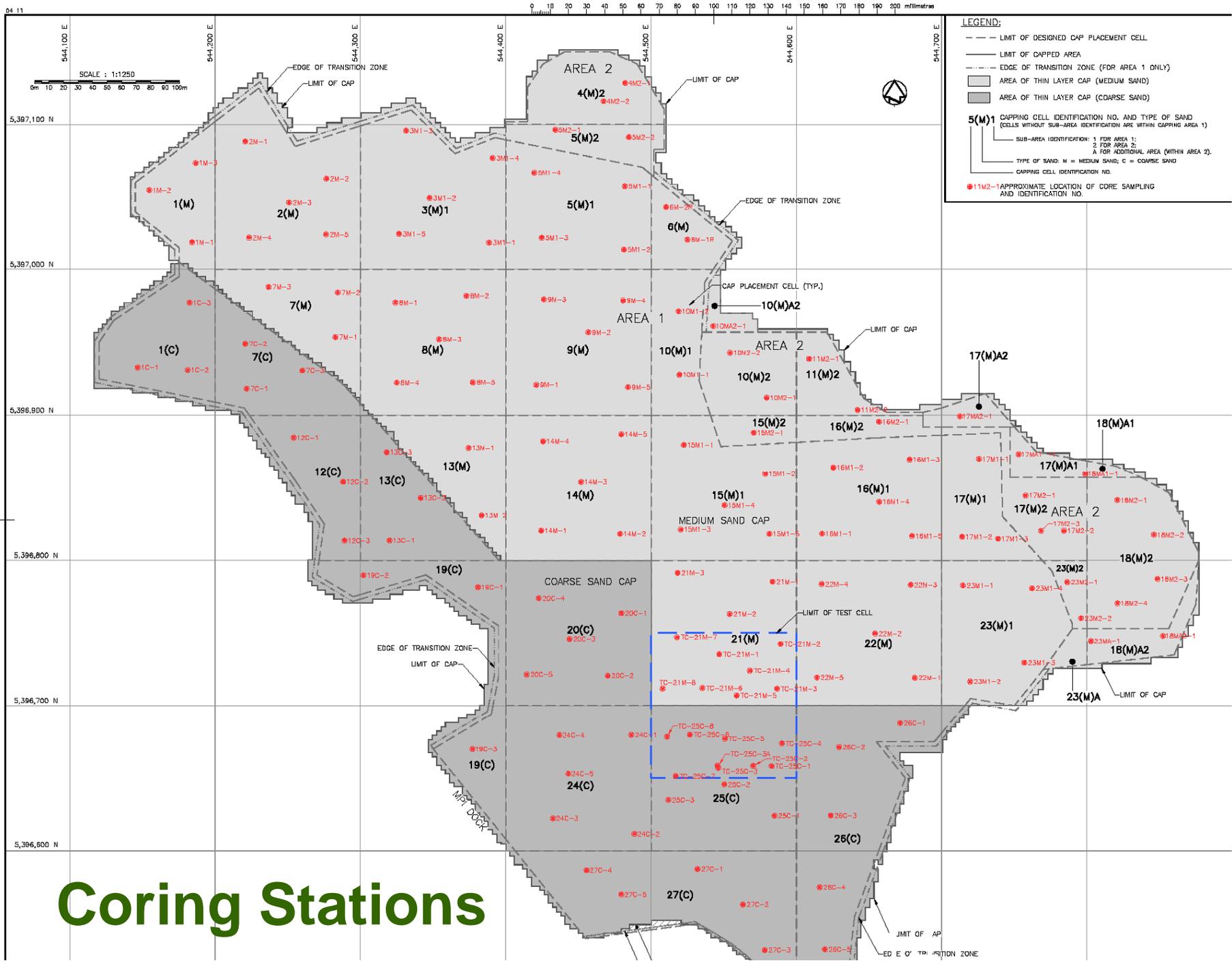
Implementation – Testing Cell

- Objective of the testing cell is to try out different placement methods to meet performance criteria
- Test cell chosen to cover both medium and coarse sand area
- Duration: 1 week
- Thickness Verification: 16 cores



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Coring Stations

Capping Operation Summary

- Capped 23 ha with medium/coarse sand
- Placed 36,000 tonnes of coarse; 49,600 tonnes of medium
- Average production 4,635 m²/day or 1,616 tonnes/day
- Started capping on June 5 and finished on Aug 5, 2012
- 3 hours of delay due to weather; 26 hours of delay due to mechanical problems



Cost of TLC Implementation

- Estimate at SMO stage: \$3.43 million (2007)
- Estimate at 33% design (excluding project management cost): \$5 million (2010)
- Estimate at 99% design stage (excluding project management cost): \$6 million (2011)
- Tender = received five bids; lowest price exceeded budget. Switched from coarse to medium sand in approximately five hectares to stay within budget (did not impact the environment or effect the integrity/functionality of the cap).
- At completion (excluding project management cost): \$6.3 million



Cost of TLC Implementation

- Construction: \$6.3 million
- AECOM (supervision): \$547,656
- PWGSC (project management): \$138,400
- Post Cap Bathymetry Survey: \$15,000
- Total Cost: \$ 6,980,236
- Funds remaining at the end of project from \$7.3 million budget: \$319,764



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Lessons Learned

- The project was completed ahead of schedule due to starting the project early in the year when we had good weather.
- Allowed flexibility in the sequencing of cell being capped to maintain/maximize productivity.
- Need better methods to quantify amount of sand applied in each cell. (Used sand displacement measurements on the barge but on days where multiple cells were capped, it was difficult to determine the volume for each cell.)



Post Implementation Monitoring Studies

- Sediment Profile Imagery (SPI)
- Submerged Aquatic Vegetation and Cap Movement
- Tracer Study – to determine the mixing between the cap and native material

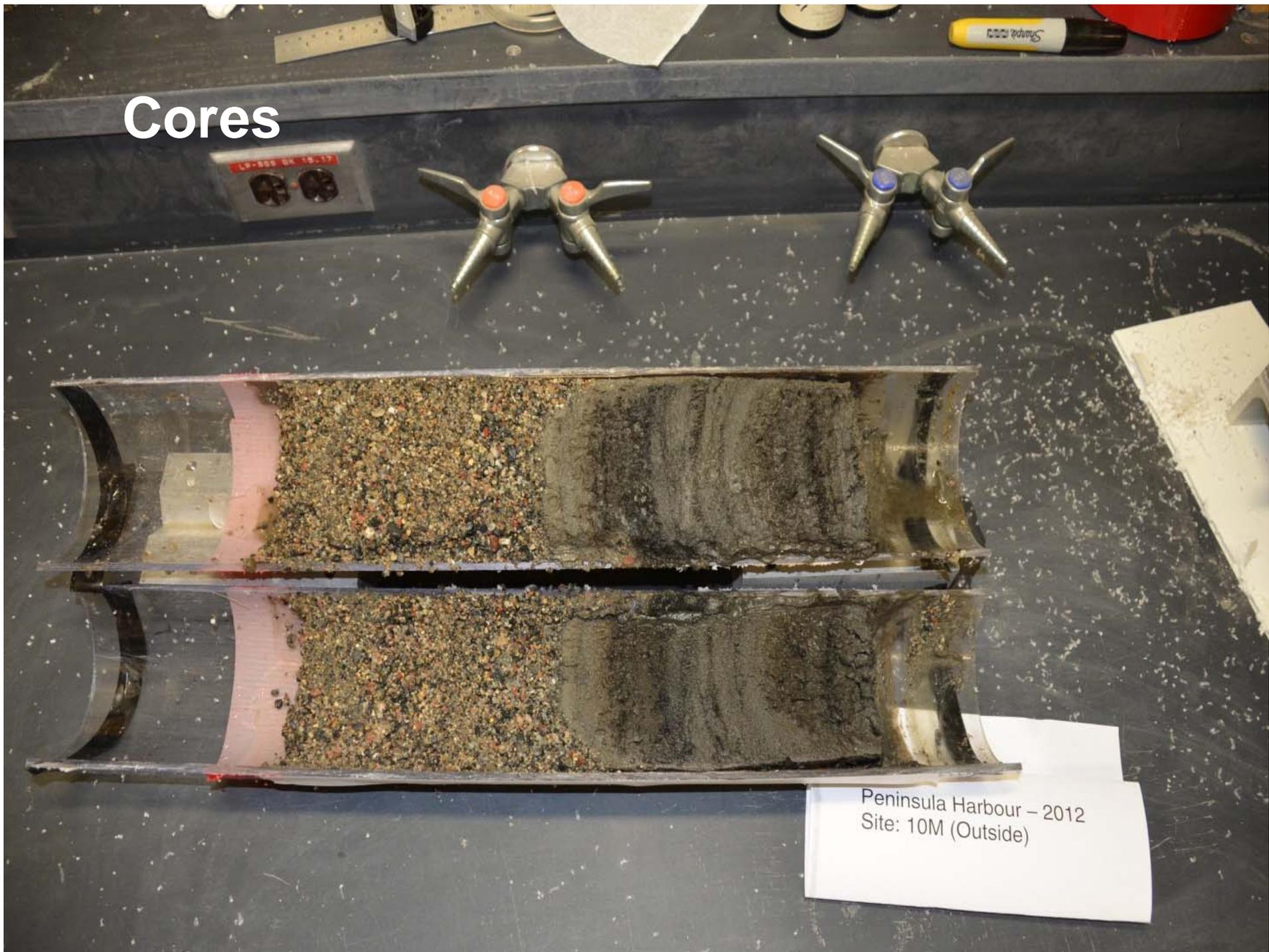


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Cores



Peninsula Harbour - 2012
Site: 10M (Outside)

Submerged Aquatic Vegetation (SAV) and Cap Movement (Northern Bioscience)

The study was designed to provide post-construction baseline data to monitor:

- the distribution and potential movement of the sand cap; and
- the recovery of SAV within the cap



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Submerged Aquatic Vegetation

- Stonewort (*Chara*)
- Pondweed (*Potamogeton*)
- Canada Waterweed (*Elodea canadensis*)



Survey Grid



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Cap Imagery

Inside the Cap



Outside the Cap

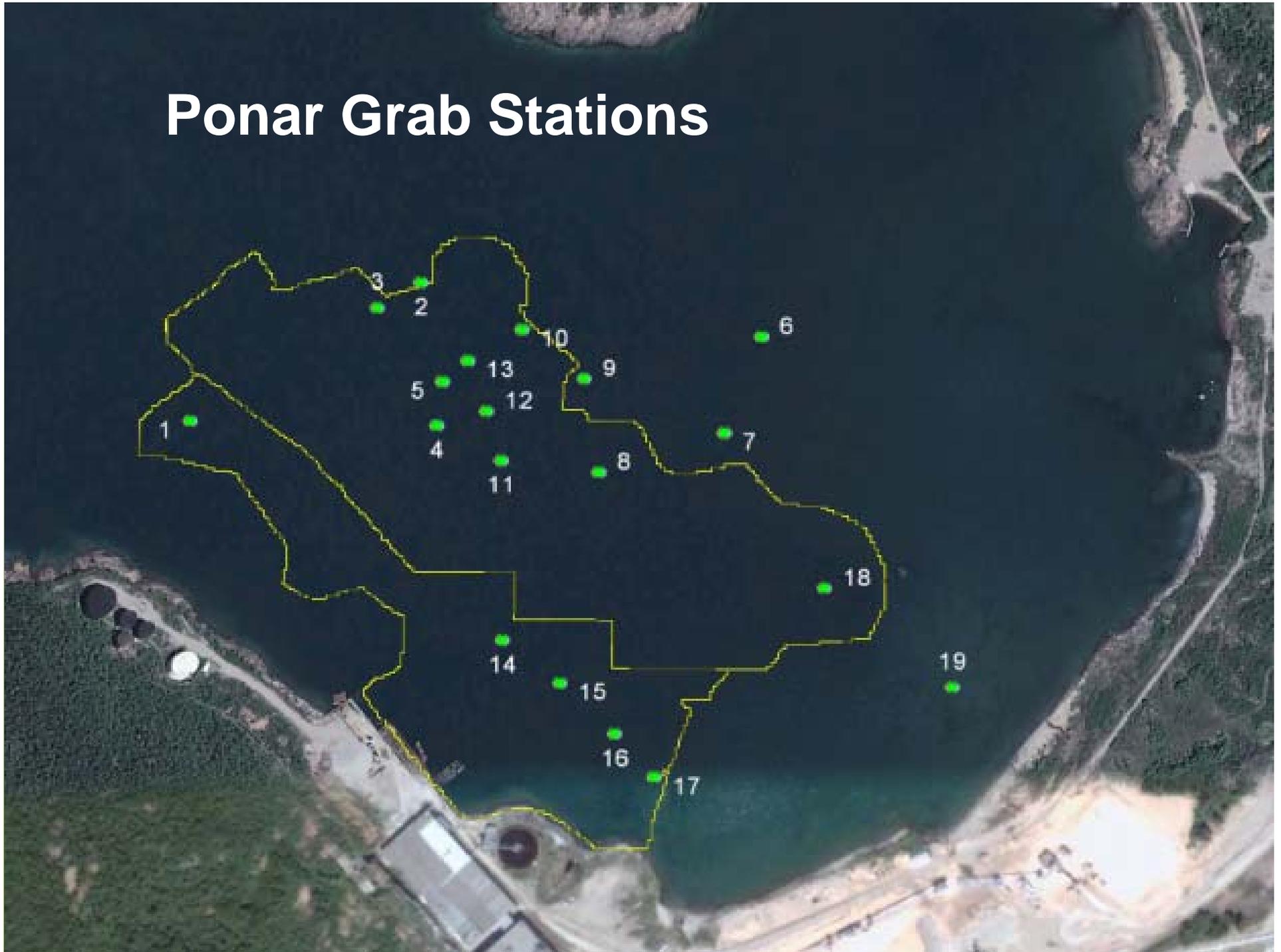


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Ponar Grab Stations



Capping Material



Cap Material from Grab Sampler



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Outside Cap

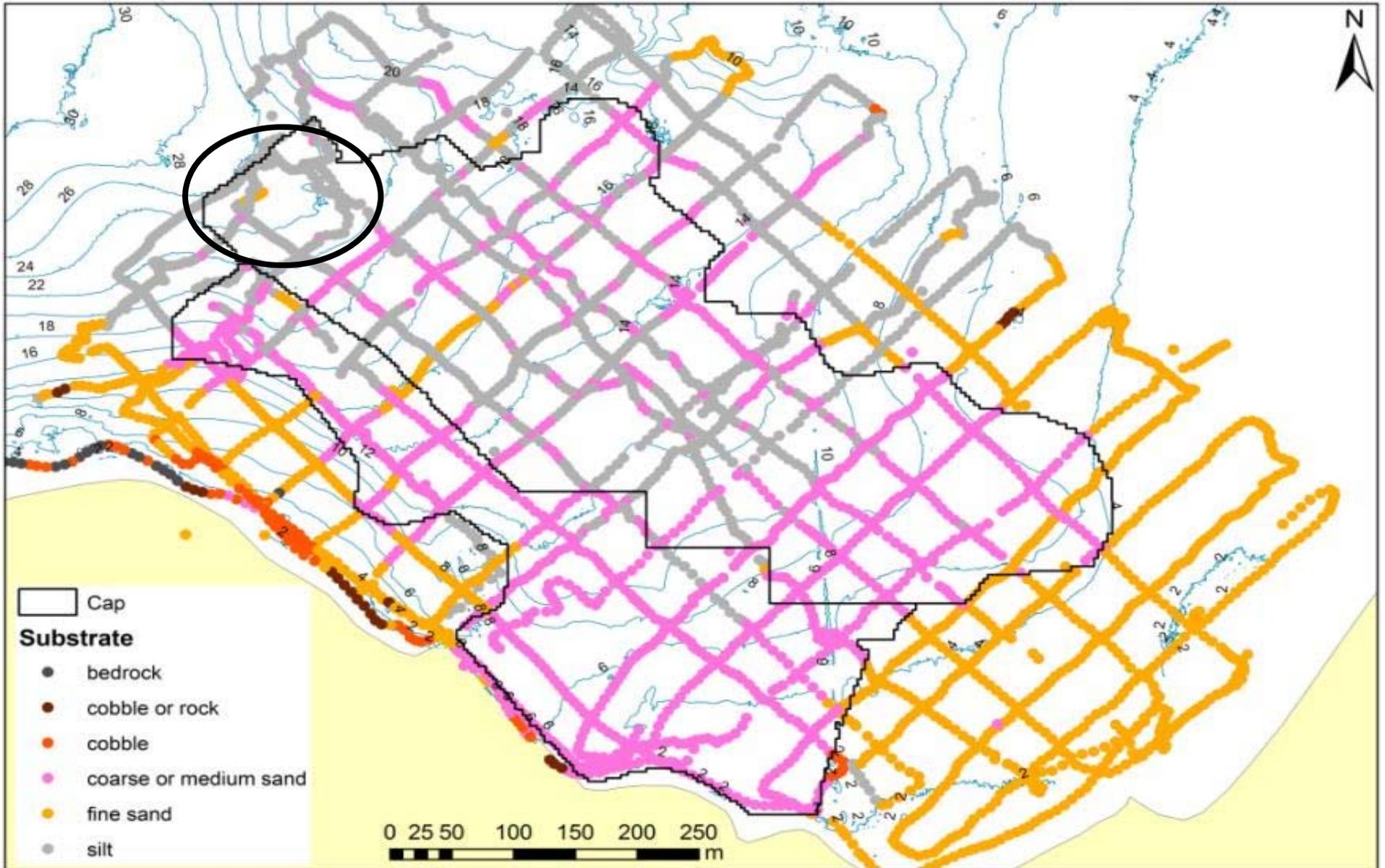


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Results – Cap Substrates



Core Thickness

Photo Log - Piston Core Measurement:

Marathon Ontario Jellicoe Cove Peninsula Harbour
Peninsula Harbour Sediment Remediation

Cell 1(M) Piston Core Photographs

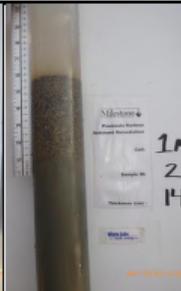
		
Core ID: 1M-1 Measured TLC Thickness: 19.5cm	Core ID: 1M-2 Measured TLC Thickness: 14cm	Core ID: 1M-3 Measured TLC Thickness: 16.5cm
No Additional Cores Collected for Cell 1(M)	No Additional Cores Collected for Cell 1(M)	No Additional Cores Collected for Cell 1(M)

Photo Log - Piston Core Measurement:

Marathon Ontario Jellicoe Cove Peninsula Harbour
Peninsula Harbour Sediment Remediation

Cell 2(M) Piston Core Photographs

		
Core ID: 2M-1 Measured TLC Thickness: 21.5cm	Core ID: 2M-2 Measured TLC Thickness: 18.5cm	Core ID: 2M-3 Measured TLC Thickness: 23cm
		No Additional Cores Collected for Cell 2(M)
Core ID: 2M-4 Measured TLC Thickness: 17.5cm	Core ID: 2M-5 Measured TLC Thickness: 17cm	

Photo Log - Piston Core Measurement:

Marathon Ontario Jellicoe Cove Peninsula Harbour
Peninsula Harbour Sediment Remediation

Cell 3(M)1 Piston Core Photographs

		
Core ID: 3M1-1 Measured TLC Thickness: 20.5cm	Core ID: 3M1-2 Measured TLC Thickness: 15cm	Core ID: 3M1-3 Measured TLC Thickness: 20cm
		No Additional Cores Collected for Cell 3(M)1
Core ID: 3M1-4 Measured TLC Thickness: 23cm	Core ID: 3M1-5 Measured TLC Thickness: 20.5cm	



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Before - After

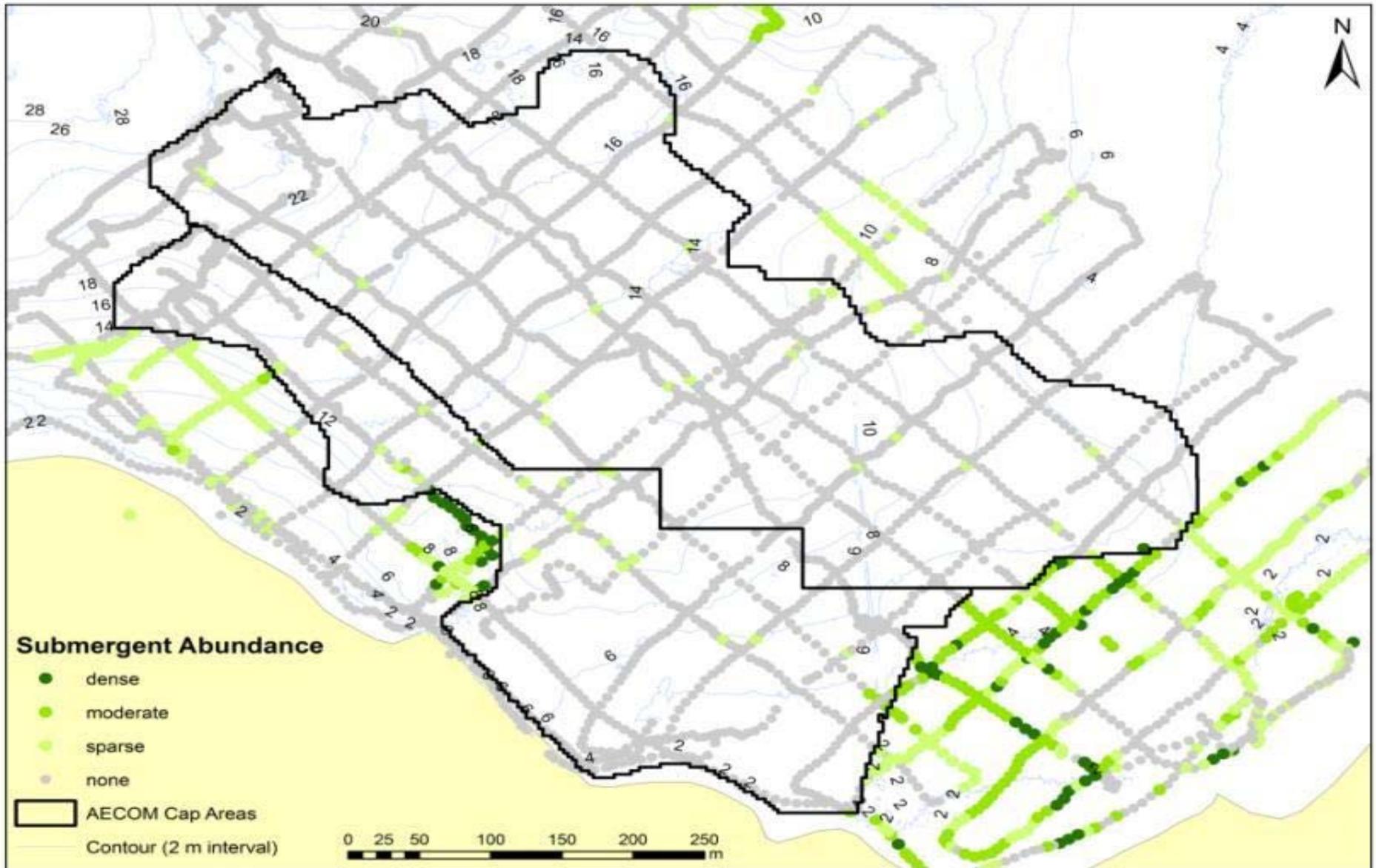


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SAVs



Long Term Monitoring Studies

- Re-colonization of submerged aquatic vegetation and cap movement study (0, 1, 3, 5, 10 yrs)
- Re-colonization of benthic community (5, 10, 15, 20)
- Benthic invertebrate tissue survey (Hg) (5, 10, 15, 20)
- Fish tissue survey (5, 10, 15, 20)
- Sediment Chemistry (5, 10, 15, 20)



Thank You

- PH Sediment Remediation Technical Team
- PH Sediment Remediation Management Committee
- Community Liaison Committee
- EcoSuperior Environmental Programs

