MERCURY IN BELFAST BAY, MAINE, SEDIMENT
CURRENT UNDERSTANDING & NORDIC AQUAFARM'S PROPOSED WATER PIPELINE INSTALLATION WORK

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DISCUSSION DOCUMENT
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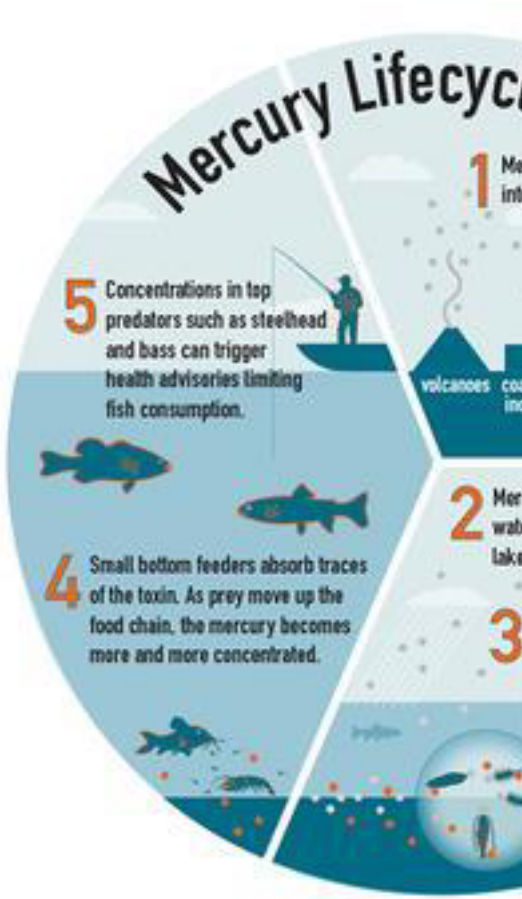
DISCUSSION TOPICS

1. What do we know about mercury, generally
2. What do we know about mercury in Belfast Bay sediments
3. Mercury limits applicable to Belfast Bay sediments
4. Nordic Aquafarm's proposed pipeline work

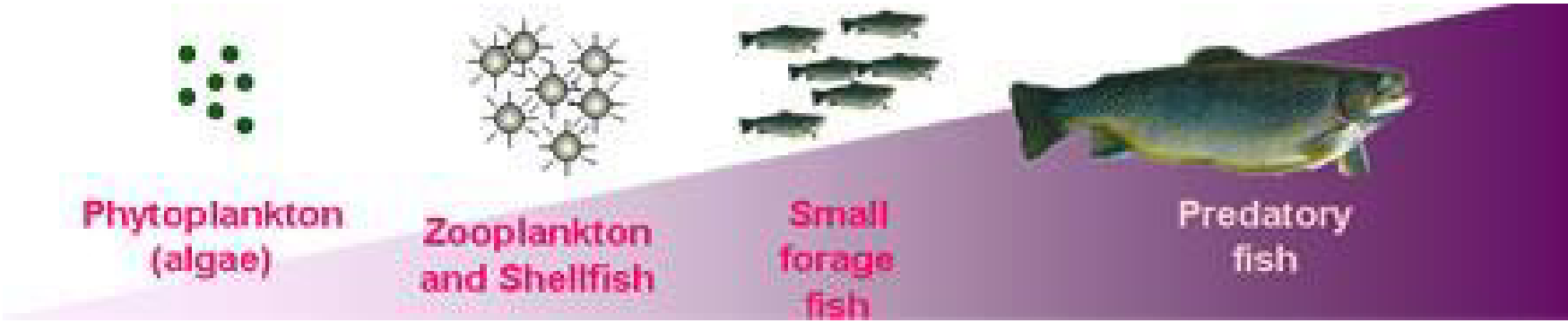
GENERALLY ACCEPTED VIEWS OF MERCURY IN THE ENVIRONMENT

- Three forms of mercury:
  - Elemental (the type in older-style thermometers)
  - Inorganic (the type found in natural deposits)
  - Organic (commonly occurring as methyl mercury)
- **Methyl mercury is the form of mercury that most concerns scientists**
- Mercury pollution occurs nearly everywhere, including Maine… primarily from MW coal-fired power plants
- All mercury is persistent in the environment



THE TYPE OF MERCURY IS IMPORTANT

- Methyl mercury is formed in water bodies and wetlands by micro-organisms t inorganic mercury to its organic (methylated) form



- Methyl mercury accumulates and biomagnifies in the food chain
- By far, the biggest bioconcentration step is from sediment-water to phytopla
- Long-lived, predatory fish (e.g., tuna and swordfish) typically contain the hig
- Women of childbearing age and children are most sensitive to exposure

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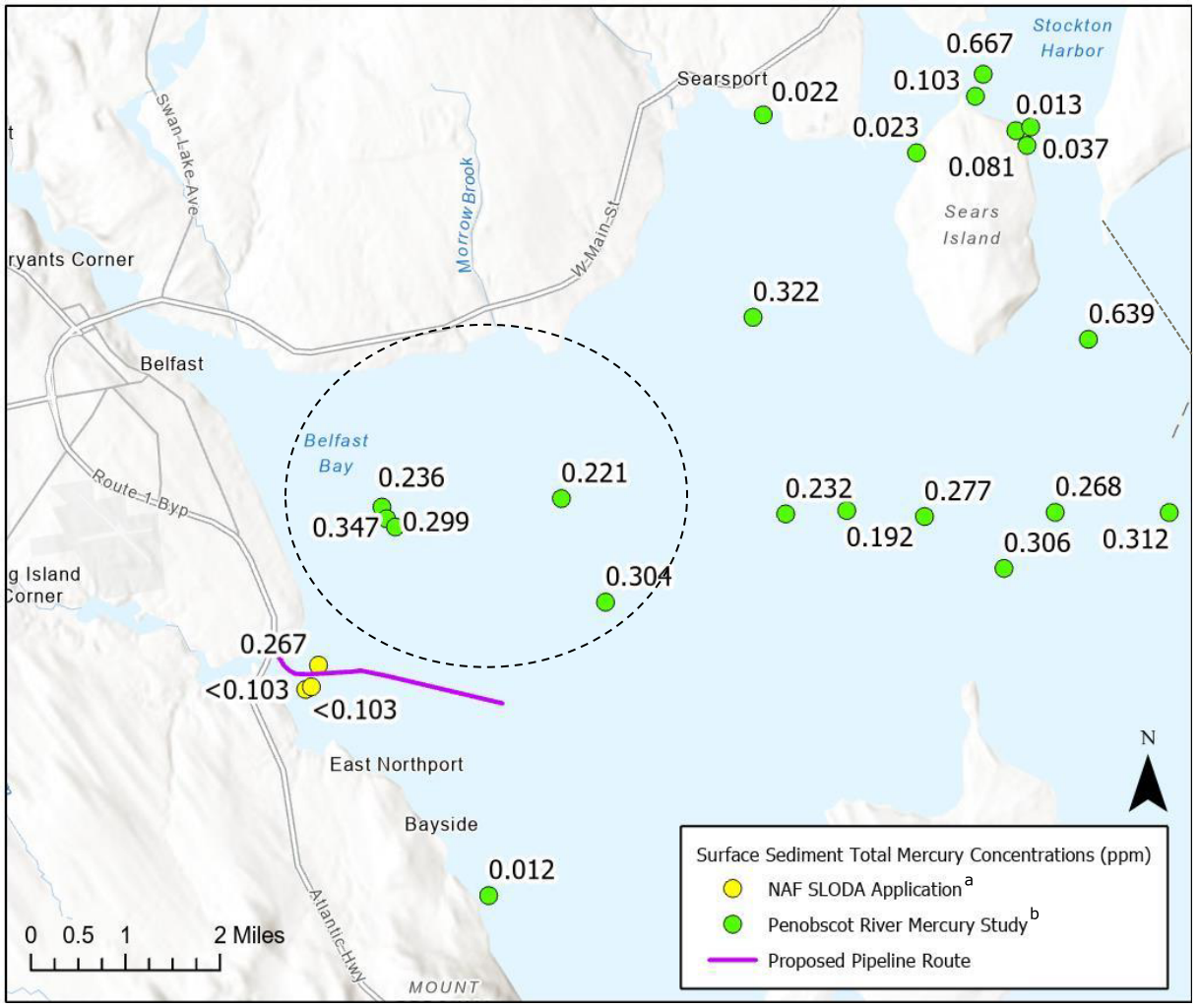
BELFAST BAY SEDIMENT DATA FOR TOTAL MERCURY



a. Nordic Aquafarms Site Location of Development Act (SLODA) Application. Section 18. https://www.maine.gov/dep/ftp/projects/nordic/applications/SLODA/Section%2018%20-%20Solid%20Waste/

b. Penobscot River Mercury Study: Phase II Study Report, Page 16 http://www.penobscotmercurystudy.com/documents/court-orders/652-phase-ii-final-report_chapter1-tables-and-figures.pdf

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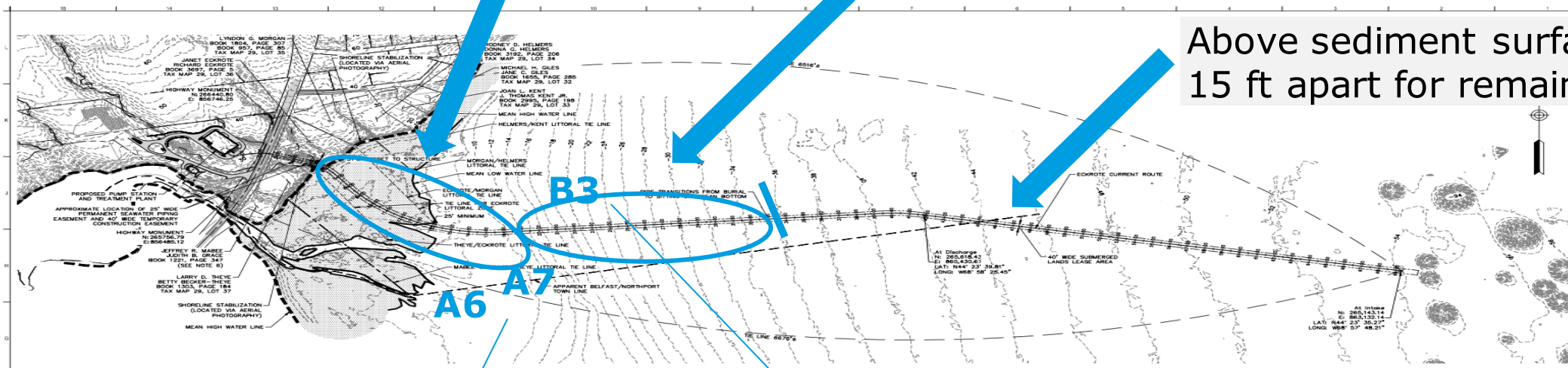
NAF SEDIMENT TESTING ALONG PROPOSED PIPELINE

5-10 ft deep x 30 ft wide trench in intertidal zone

10 ft deep x 30 ft wide trench in offshore subtidal zone

Above sediment surfa
15 ft apart for remain



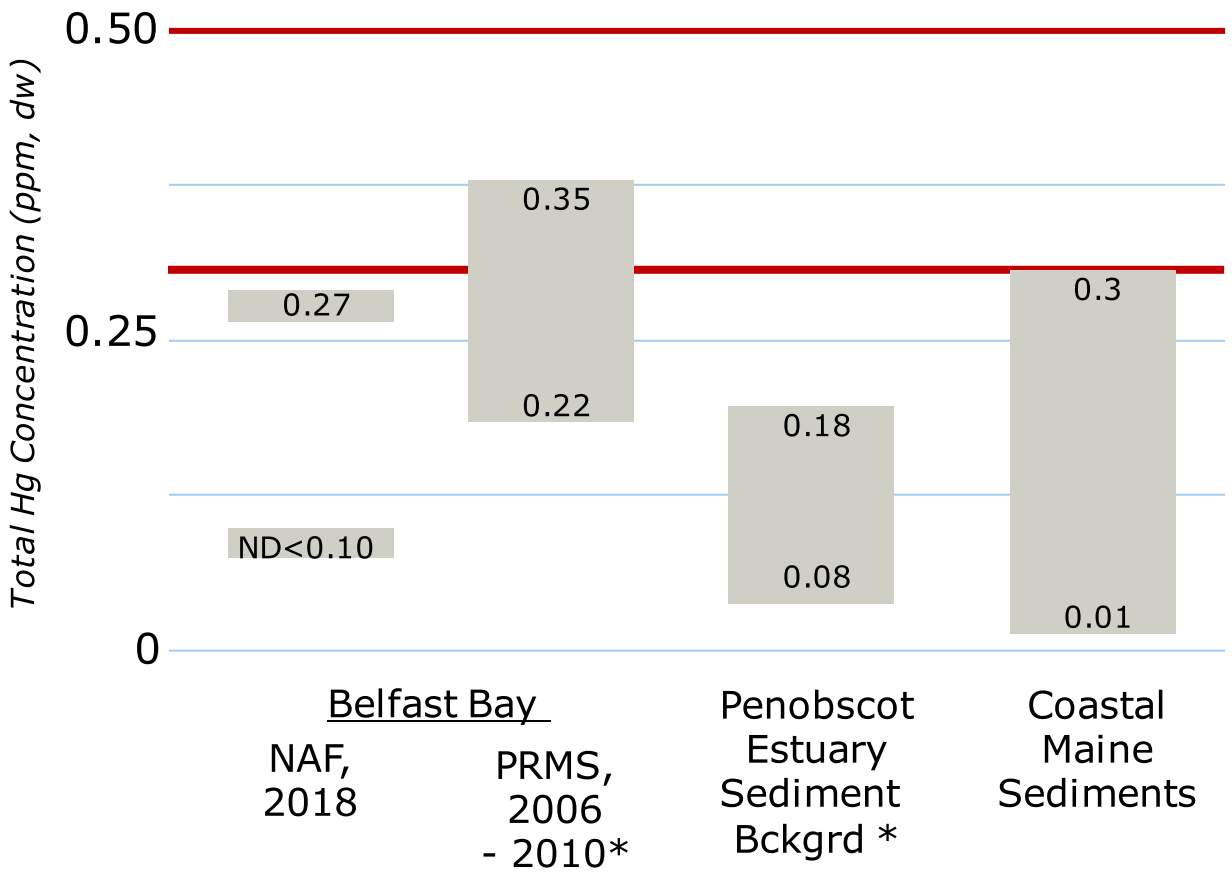
Total Mercury = not detected

One composite sample from two sediment cores representing sediment from 0-1 ft (A6) + 0-3.75 ft (A7) depths

Total mercury = 0.27 ppm

One composite sample from one sediment core representing sediment from 0 - 6.5 ft deep

TOTAL MERCURY (PPM) IN BELFAST BAY SEDIMENTS & SEDIMENT CLEANUP VALUES RECOMMENDED FOR PENOBSCOT R



0.5 ppm = Sediment PRG protective and the local consumer *

0.3 ppm = Sediment PRG expected t fish tissue action level in

0.2 ppm = *for methyl mercury…* l level in edible tissues of sport fish specifically for lobster, shellfish, a consumption.

- Maine Center for Disease Contr (MeCDC) guideline used to dete fish consumption advisories.
- Maine Department of Marine Re uses the guideline when design crab fishing closure areas. *

Phase 3 Penobscot River Estuary Study, Sept 2018

 # See: https://www.maine.gov/dhhs/mecdc/environmental-health/eohp/fish/documents/action-levels-writeup.pdf

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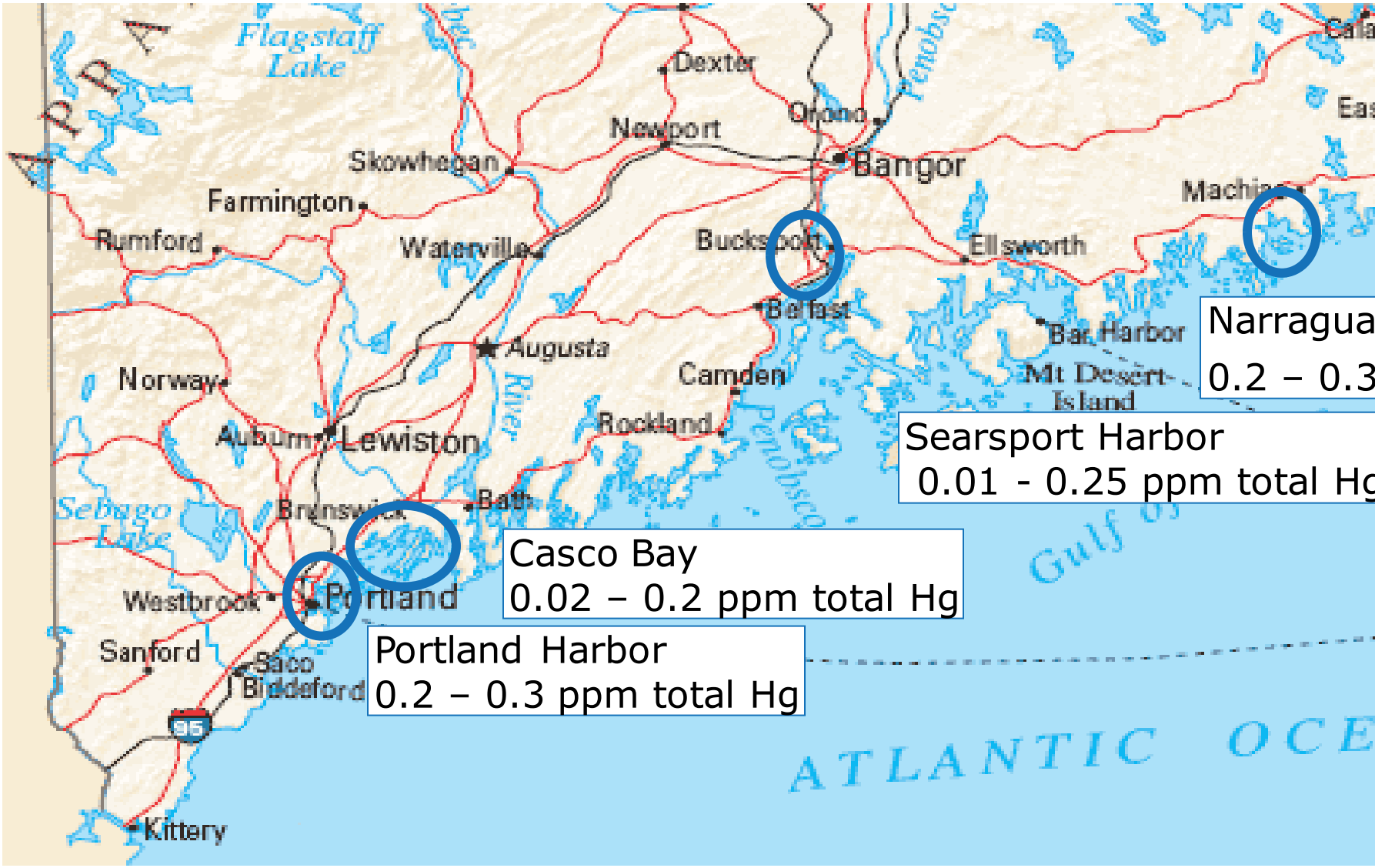
TOTAL MERCURY IN COASTAL MAINE SEDIMENT



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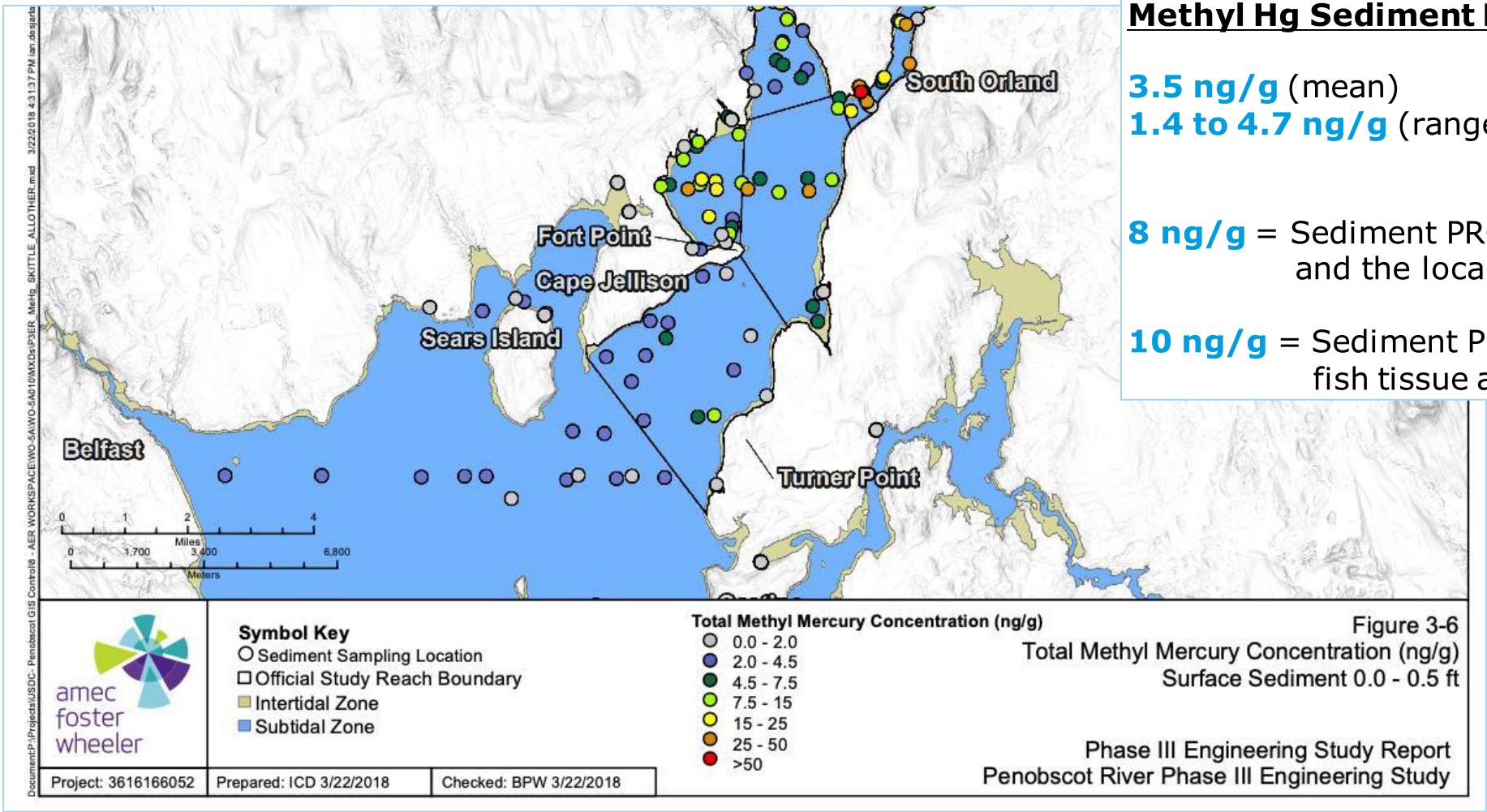
METHYL MERCURY IN BELFAST BAY SEDIMENTS



Methyl Hg Sediment PRG

3.5 ng/g (mean)
1.4 to 4.7 ng/g (range)
] Backgro upper P and est

8 ng/g = Sediment PRG protective and the local consumer

10 ng/g = Sediment PRG expecte fish tissue action level

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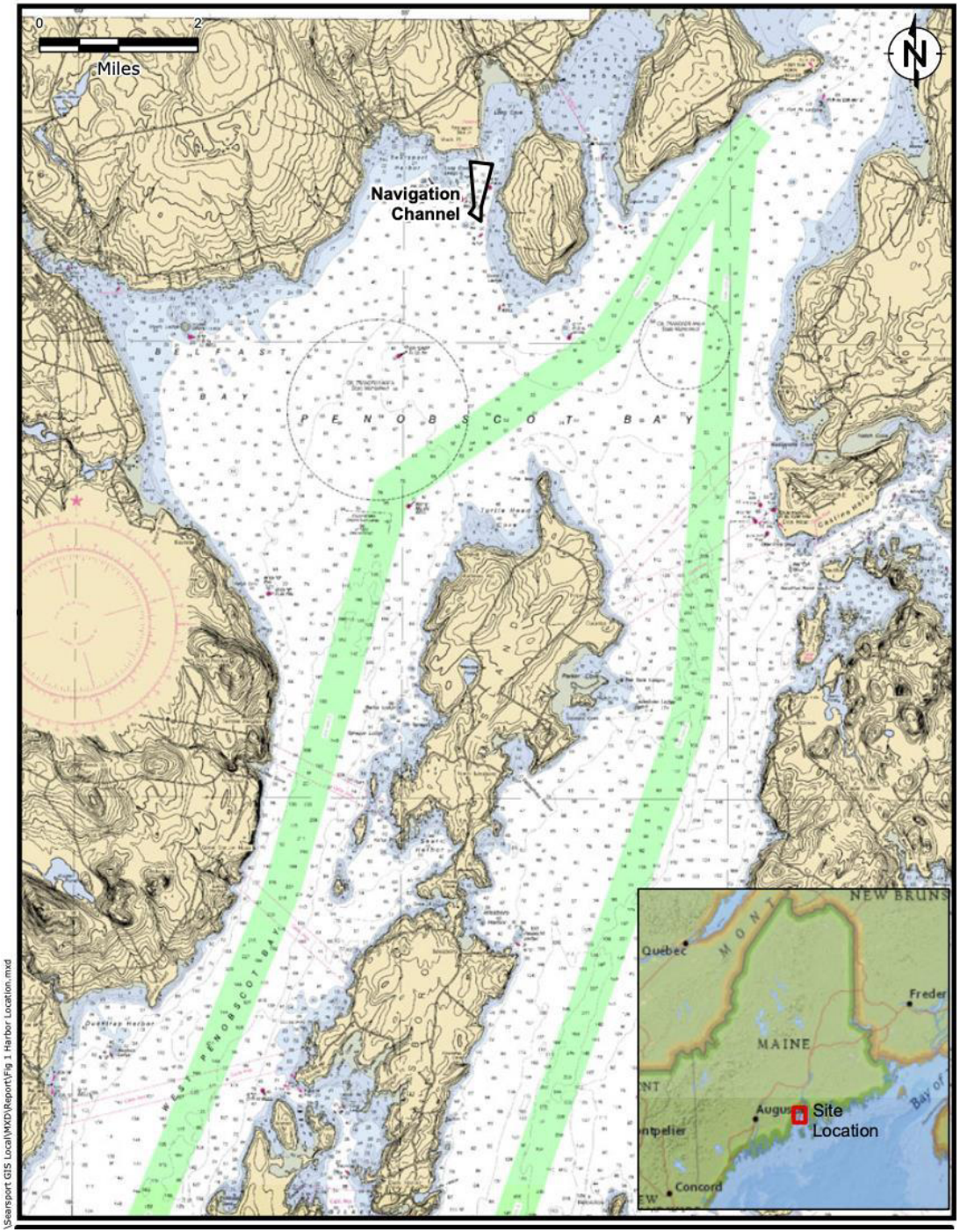
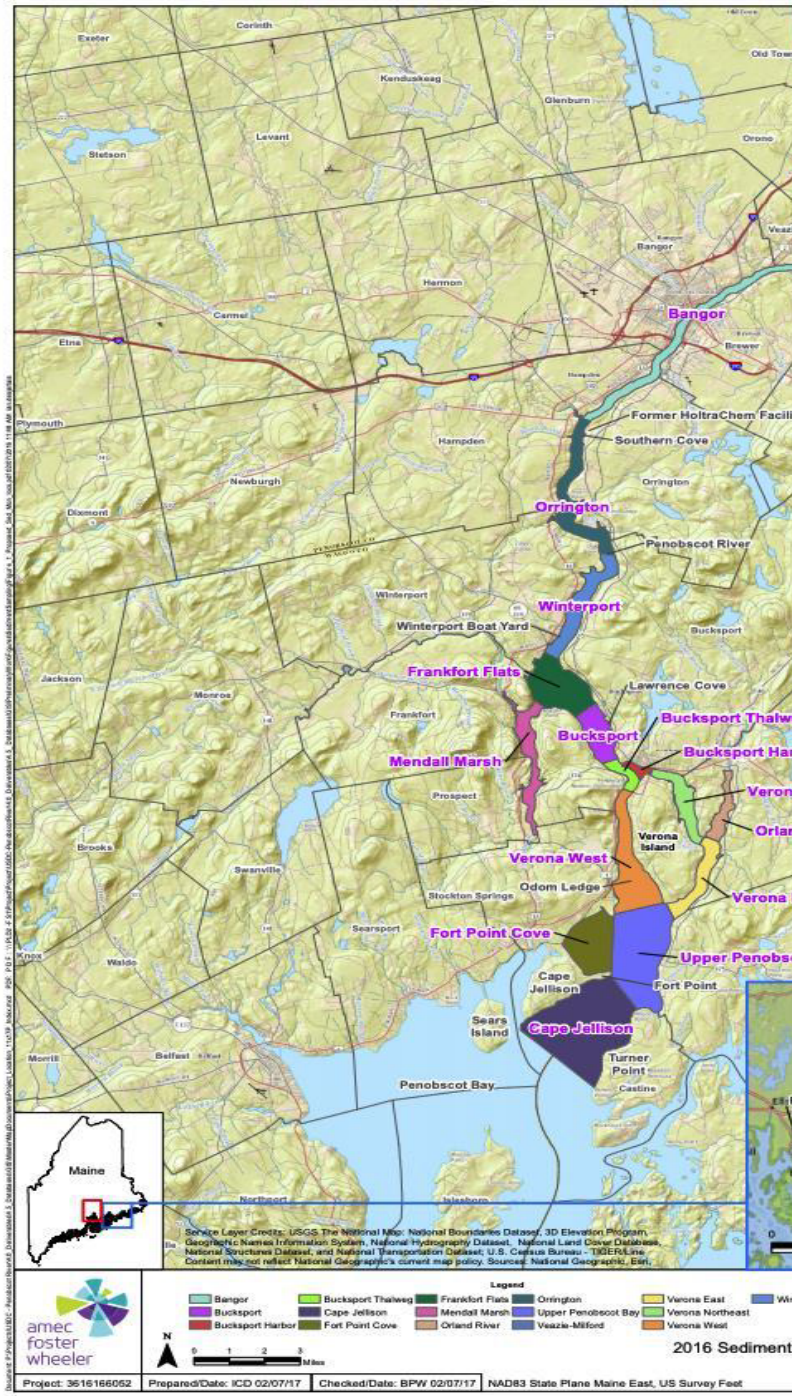
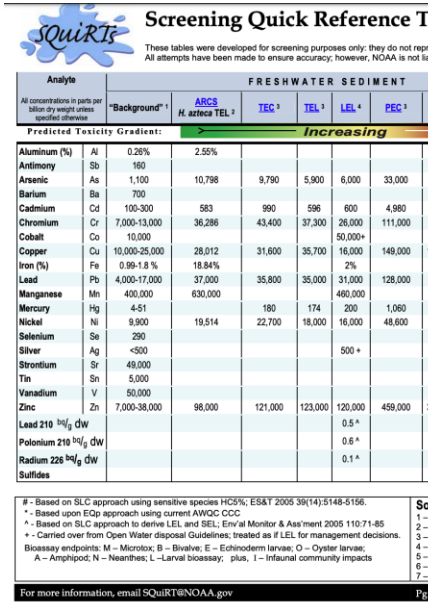


\Searsport GIS Local\MXD\Report\Fig 1 Harbor Location.mxd



NOAA SEDIMENT SCREENING VALUES

- Total mercury were based on effects to aquatic life determined from studies conducted in 1996:
  - (ER-L) low effects level = 0.15 ppm
  - (ER-M) threshold effect level = 0.71 ppm
- **NOAA acknowledges screening levels have not been updated since 2008; values for mercury and other substances are "out dated" * and no longer reflect current state of the science**
- Today… USEPA, US Army Corps, and State of Maine recommend reliance on site-specific testing work and regional / local background levels to define sediment screening values



SQuiRTs Screening Quick Reference T

These tables were developed for screening purposes only; they do not repr
All attempts have been made to ensure accuracy; however, NOAA is not li

Analyte		FRESHWATER SEDIMENT						
All concentrations in parts per billion dry weight unless specified otherwise		"Background" [1]	ARCS *H. azteca* TEL [2]	TEC [3]	TEL [3]	LEL [4]	PEC [3]	
Predicted Toxicity Gradient:						> Increasing		
Aluminum (%)	Al	0.26%	2.55%					
Antimony	Sb	160						
Arsenic	As	1,100	10,798	9,790	5,900	6,000	33,000	
Barium	Ba	700						
Cadmium	Cd	100-300	583	990	596	600	4,980	
Chromium	Cr	7,000-13,000	36,286	43,400	37,300	26,000	111,000	
Cobalt	Co	10,000				50,000+		
Copper	Cu	10,000-25,000	28,012	31,600	35,700	16,000	149,000	
Iron (%)	Fe	0.99-1.8 %	18.84%			2%		
Lead	Pb	4,000-17,000	37,000	35,800	35,000	31,000	128,000	
Manganese	Mn	400,000	630,000			460,000		
Mercury	Hg	4-51		180	174	200	1,060	
Nickel	Ni	9,900	19,514	22,700	18,000	16,000	48,600	
Selenium	Se	290						
Silver	Ag	<500				500 +		
Strontium	Sr	49,000						
Tin	Sn	5,000						
Vanadium	V	50,000						
Zinc	Zn	7,000-38,000	98,000	121,000	123,000	120,000	459,000	
Lead 210 bq/g dw						0.5 ^		
Polonium 210 bq/g dw						0.6 ^		
Radium 226 bq/g dw						0.1 ^		
Sulfides								

- Based on SLC approach using sensitive species HC5%; ES&T 2005 39(14):5148-5156.
* - Based upon EQp approach using current AWQC CCC
^ - Based on SLC approach to derive LEL and SEL; Env'al Monitor & Ass'ment 2005 110:71-85
+ - Carried over from Open Water disposal Guidelines; treated as if LEL for management decisions.
Bioassay endpoints: M – Microtox; B – Bivalve; E – Echinoderm larvae; O – Oyster larvae;
A – Amphipod; N – Neanthes; L –Larval bioassay; plus, I – Infaunal community impacts

For more information, email SQuiRT@NOAA.gov

* https://response.restoration.noaa.gov/environmental-restoration/environmental-assessment-tools/squirt-cards.html

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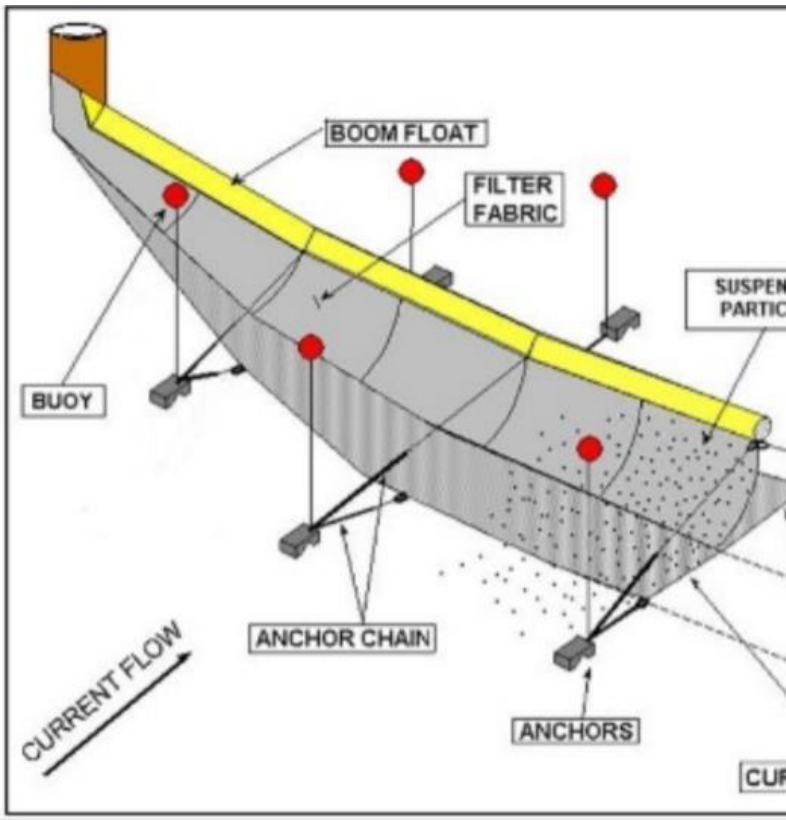
NAF ACTIONS TO MINIMIZE DISTURBANCE OF SEDIM
DURING PIPELINE INSTALLATION

- ✓ Adopting current best engineering practices for sediment work
- ✓ Working at low tide to minimize sediment resuspension
- ✓ Using anchored turbidity curtains to contain any resuspended sediment during work
- ✓ Replacing excavated sediment with clean fill and taking the sediment to a MeDEP-approved solid waste facility



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