



# Defining Sediment Management Areas in the St. Clair River Using Invertebrate Methylmercury Tissue Concentrations

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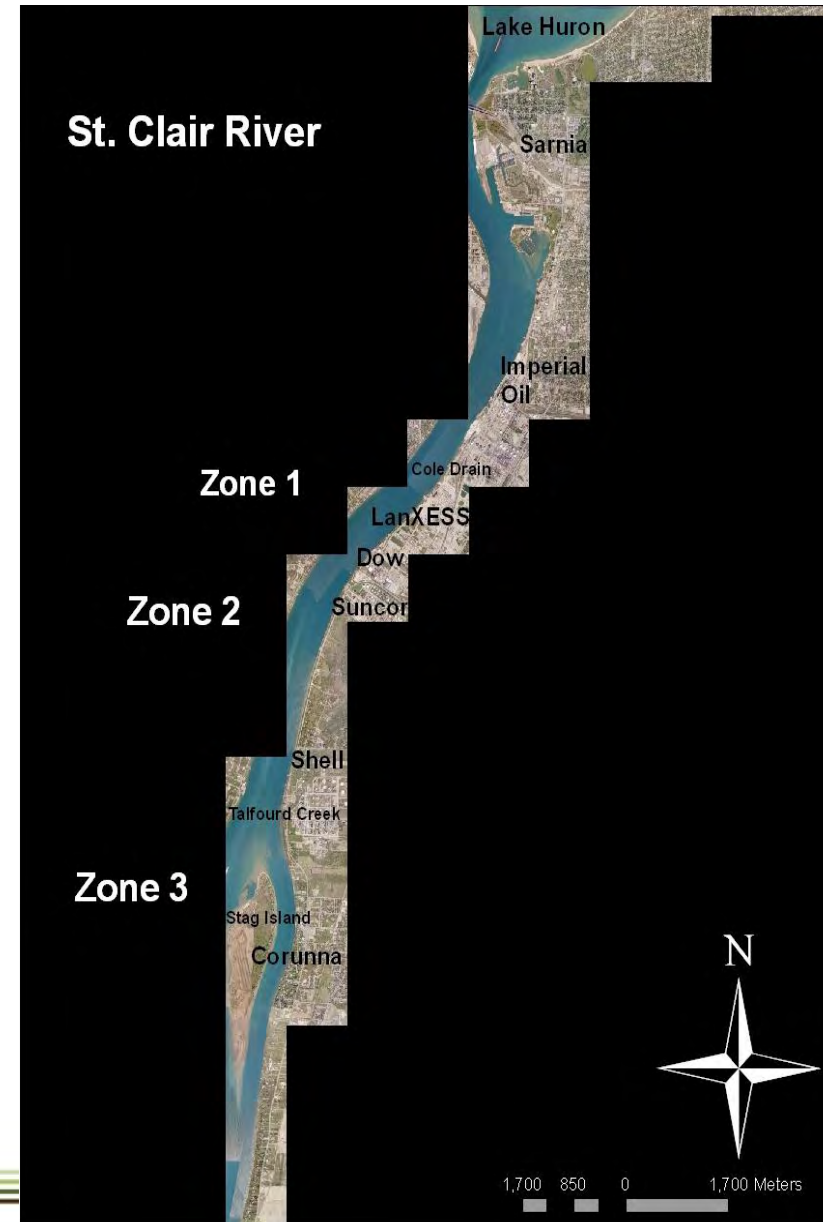
# Definitions:

- Sediment: mud at the bottom of the river along the Canadian shoreline
- Invertebrates: organisms without backbones e.g. insects, worms, clams. **Benthic invertebrates** (live in sediment)
- Contaminants of Concern: Hexachlorobenzene, Octachlorostyrene, Hexachlorobutadiene, **Mercury**
- Total Mercury and Methyl Mercury

# Area of Interest

- Sediment was contaminated along the Canadian shoreline due to industrial and municipal point and non-point sources.
- Based on benthic community impairment the RAP identified three areas for further study in the upper SCR :

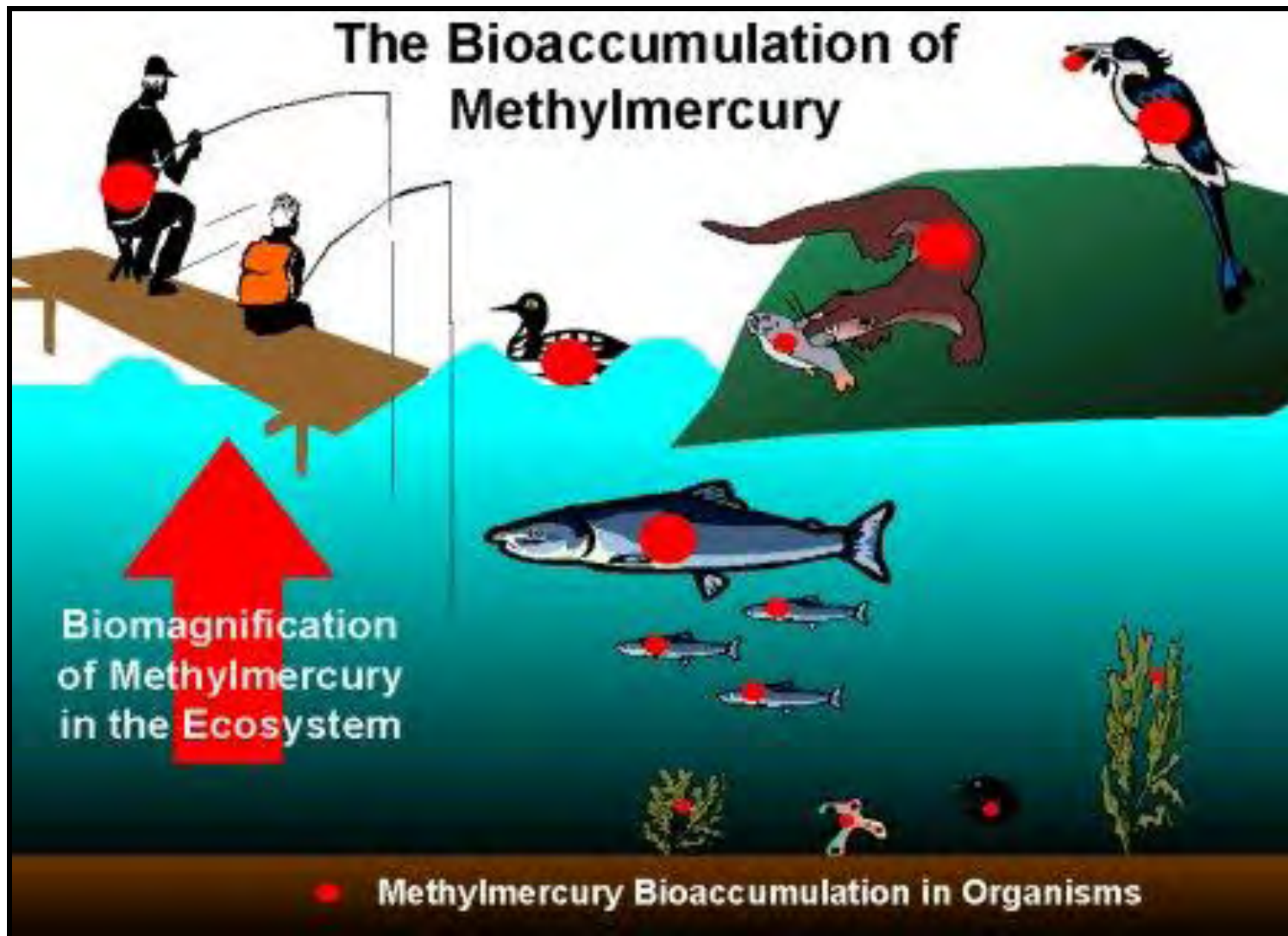
## Zones 1, 2, and 3



# Key Questions

- Are fish or wildlife harmed by chemicals in sediment, invertebrates and fish?
- Does sediment need to be cleaned up to prevent harm to fish or wildlife?
- If so, which areas are most important for cleanup?
- What areas need to be studied more before decisions can be made?

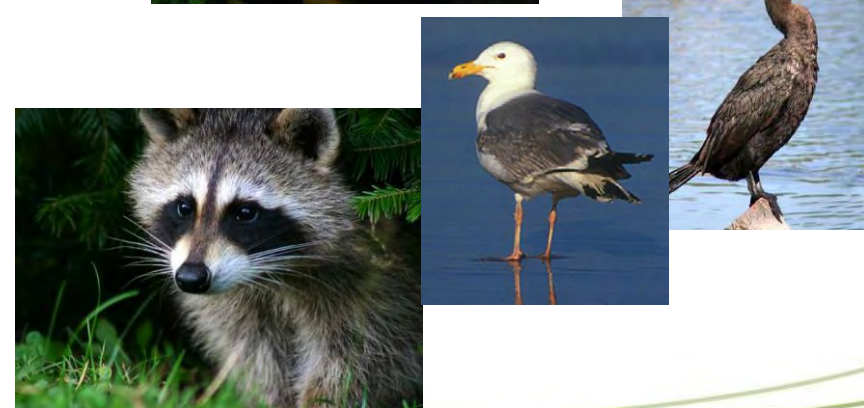






# Environmental Risk Assessment to Assess Risk from Bioaccumulation of Contaminants

- Invertebrates (insects, clams, and worms)
- Fish (sportfish such as northern pike and pickerel, and forage fish such as shiners)
- Birds (herring gull, double-crested cormorant)
- Mammal (raccoon)



# Risk Assessment Conclusion

- Risks driven by exposure and biomagnification of mercury to benthivorous fish
- No risk to fish-eating wildlife



**Redhorse Sucker**



**Northern Pike**

# The Challenge: Prioritize Cleanup Areas

- Goal: reduce mercury in fish tissue by reducing their exposure from food
- Prey living in the sediment (invertebrates) tend to have highest mercury levels
- Prey with the highest mercury tend to live in sediment with high mercury. Simplest approach is to cleanup sediment with high mercury levels
- **BUT** this relationship is complex, varies between sites, and depends on many sediment characteristics





# Approach: Focus on Areas with High Mercury in Invertebrates to Reduce Fish Exposures

- We calculated the safe range of mercury concentrations in fish prey based on safe level in fish and site-specific relationships between concentrations in fish and in worms



**Oligochaetes**

**Target average concentration of methylmercury in worms:  
13 – 15 parts per billion (“ng/g”)**

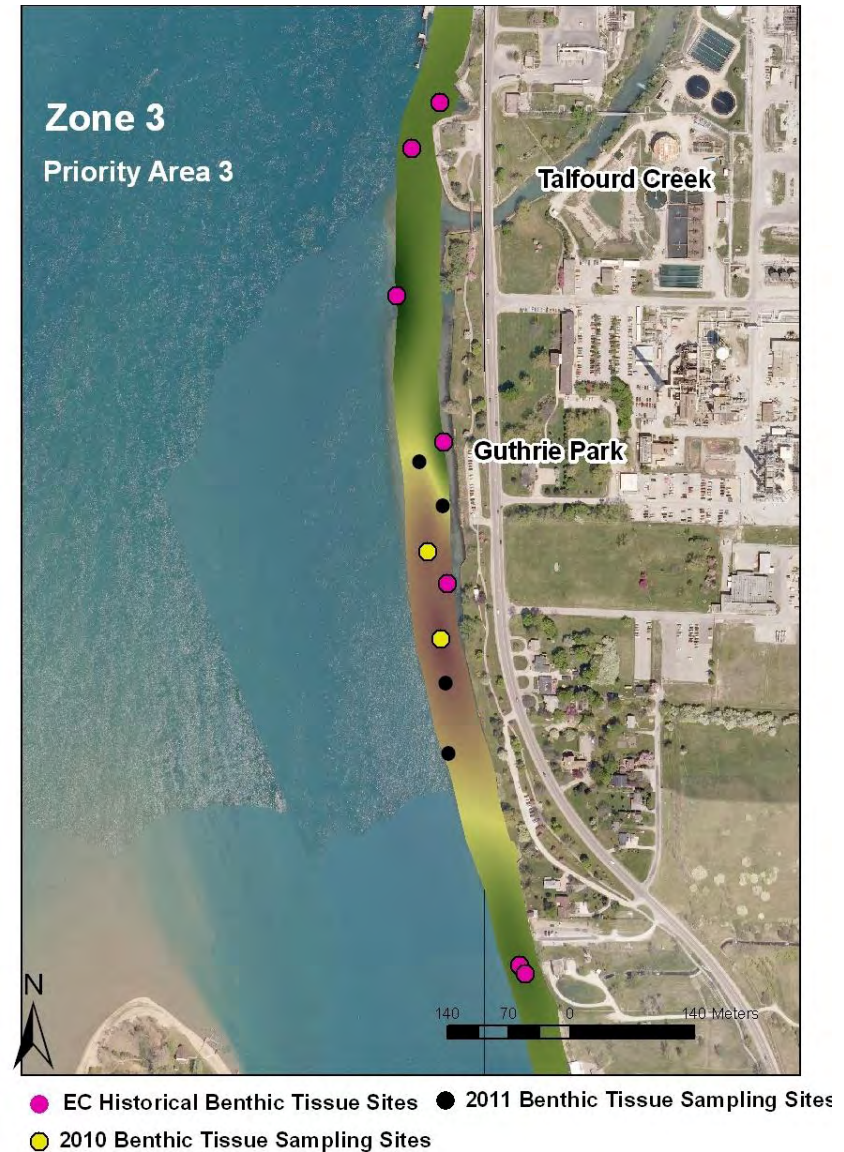
## What Areas Contribute Greatest Risk to Fish?

- Mapped measured concentrations in worms (“oligocheates”)
- Simulated removal of hot spots until average equals safe level
- Prioritized zones of risk to fish for sediment management (low, intermediate, high)





# 2010-2011 Benthic Invertebrate Survey: 16 Stations in 3 Priority Areas + 1 Reference Station





# Field Methods

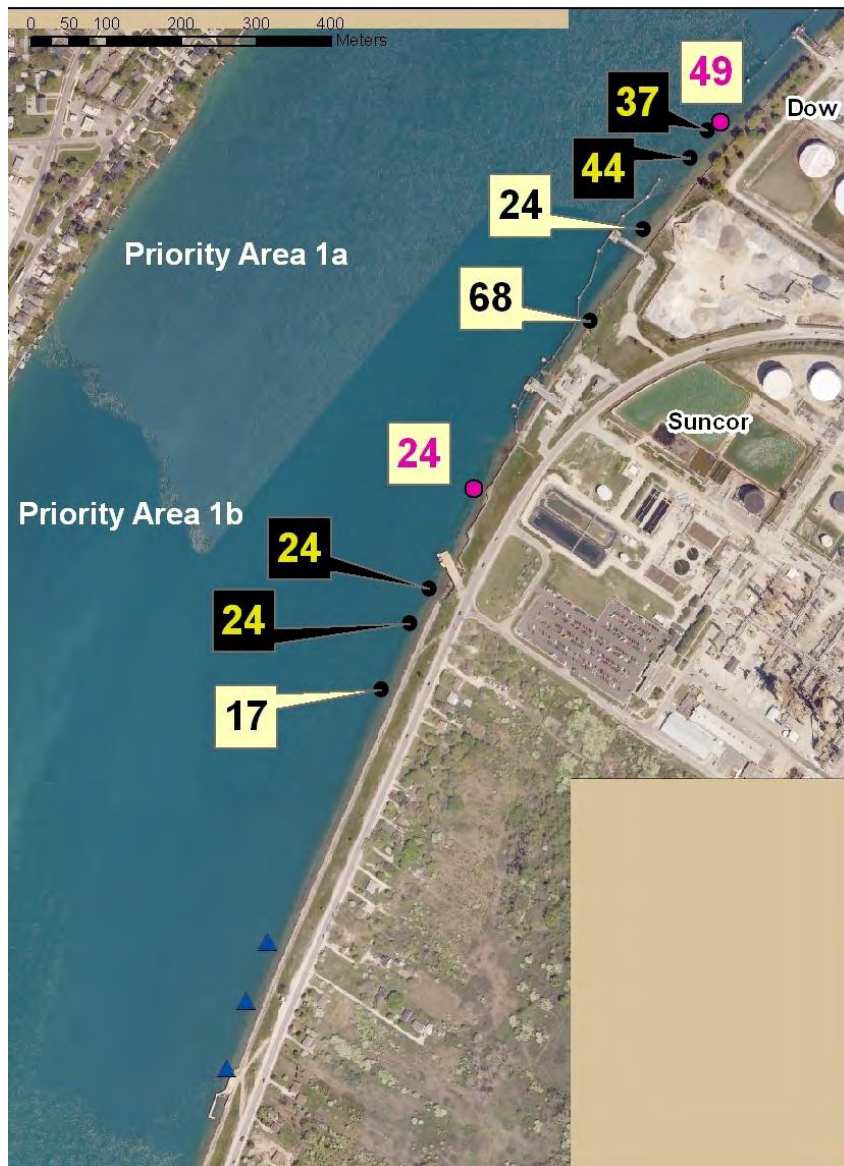
- Shipek dredge and ponar: sediment placed in buckets
- Sieved through 600  $\mu\text{m}$  mesh
- Remaining material sorted for oligochaetes
- 0.5 g required for THg and MHg analysis
- Flett Research Ltd.





# Priority Areas 1 and 2: Methylmercury in Oligocheates (ng/g dw)

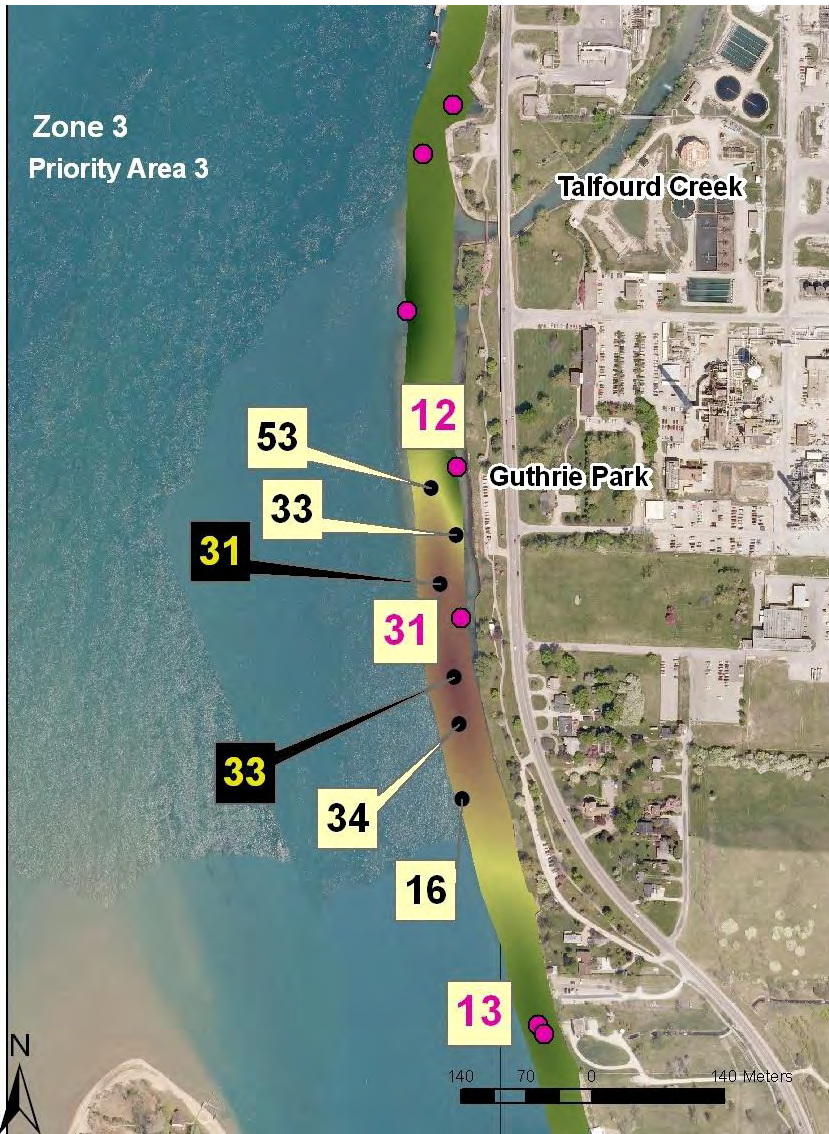
Pink font = 2001 samples  
Yellow font = 2010 samples  
Black font = 2011 samples





# Priority Area 3: Methylmercury in Oligocheates (ng/g dw)

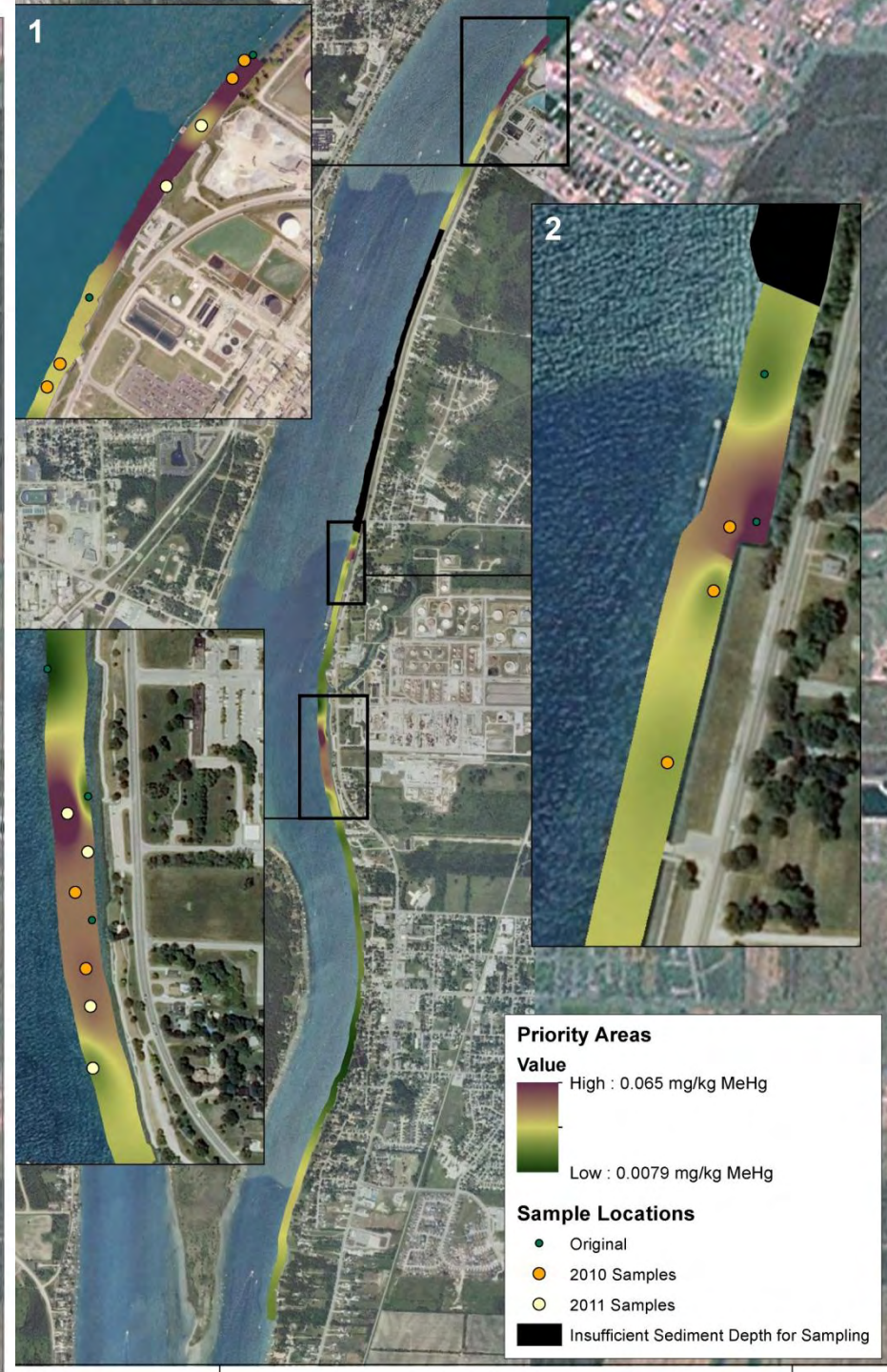
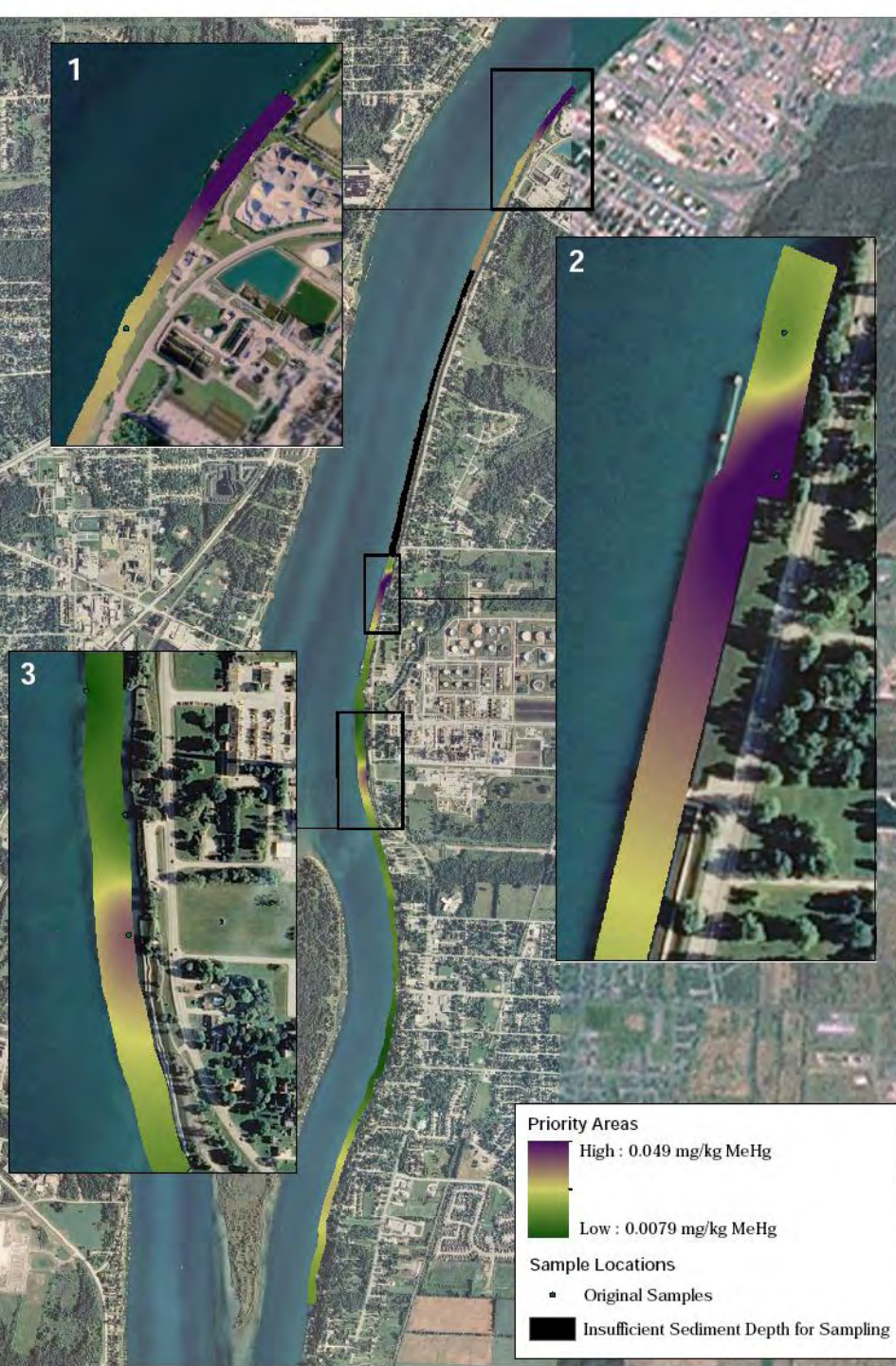
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Methylmercury in oligocheates significantly correlated with both methyl and total mercury in sediment

Methylmercury was 3-20% of total mercury







# Conclusions and Next Steps

- New data collected in 2010 and 2011 allowed the sizes and locations of Priority Areas to be refined, which is expected to result in more effective remediation
- Next, management options will be evaluated and a remedial plan developed