



Pearce Creek DMCF Baseline Exterior Monitoring Fall 2015 Results

Pearce Creek Implementation Committee
February 19, 2016

Project Overview

- Objective: Collect data from exterior monitoring locations to establish baseline conditions that will be used to monitor environmental conditions after dredged material placement starts
- First sampling event was conducted in Fall 2015
- Testing program included:
 - Surface water quality
 - Sediment chemistry – testing of target chemicals
 - Sediment bioassays – 10-day tests that evaluate organism survival
 - Benthic community – Identification of bottom-dwelling organisms, including number of species (diversity) and number of organisms (abundance)

Monitoring Schedule

- Results presented today are from the first baseline monitoring event and represent the initial characterization of existing conditions
- First dredged material placement at the Pearce Creek DMCF is anticipated in Fall 2017
- Sampling Schedule
 - Fall 2015, Spring 2016 → Year 1 baseline monitoring
 - Fall 2016, Spring 2017 → Year 2 baseline monitoring
 - Fall 2017, Spring 2018 → post-placement monitoring
- Subsequent monitoring events will occur on an as-needed basis



Sampling Overview – Fall 2015

- 10 Sampling Locations:
 - 7 Pearce Creek Lake monitoring locations
 - 1 Pearce Creek Lake reference location
 - 1 Elk River monitoring location
 - 1 Elk River reference site
- Reference locations represent areas that are outside of the influence of the DMCF



Sampling Overview

- At each location, surface water samples were collected first
- Water samples were pumped directly into the sample containers
- Surface sediments were collected using a grab sampler
 - 1 to 2 surface grabs collected at each location
 - Sediments from each grab at a location were mixed together and placed into sample jars
- Benthic organisms collected using a grab sampler



Surface Water Testing Program

- Laboratory and field data were collected to evaluate water quality
 - Field parameters measured during sample collection
 - Chemical analysis conducted by laboratory

Field Parameters

- Temperature
- Dissolved Oxygen
- Salinity
- Turbidity
- Salinity
- pH

Chemical Testing

- Phosphorus
- Aluminum
- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc
- Suspended Solids

- Results of chemical testing were compared to water quality criteria
 - Criteria set by EPA and State of Maryland to be protective of aquatic life
 - Each chemical has two criteria → one that evaluates short term (acute) exposure and one that evaluates long term (chronic) exposure

Surface Water Results

- Salinity
 - Pearce Creek Lake = freshwater
 - Elk River = oligohaline (0.5 to 5 parts per thousand salinity)
- Turbidity
 - Highly variable at Pearce Creek Lake locations because of natural factors (i.e., bank erosion, algae)
 - Low at Elk River locations
- Chemical Testing
 - Only one metal at one location exceeded water quality criteria
 - Zinc exceeded water quality criteria at location PCL-05
 - None of the Elk River samples exceeded water quality criteria



Location PCL-01



Location PCL-05

Sediment Testing Program

- Sediment characterization included 3 components:
 - Physical characterization → sediment type
 - Chemical testing
 - Benthic bioassays – evaluate if the sediment supports benthic organism survival

Physical Characterization

- Sand
- Silt
- Clay
- Gravel
- Specific Gravity

Nutrients

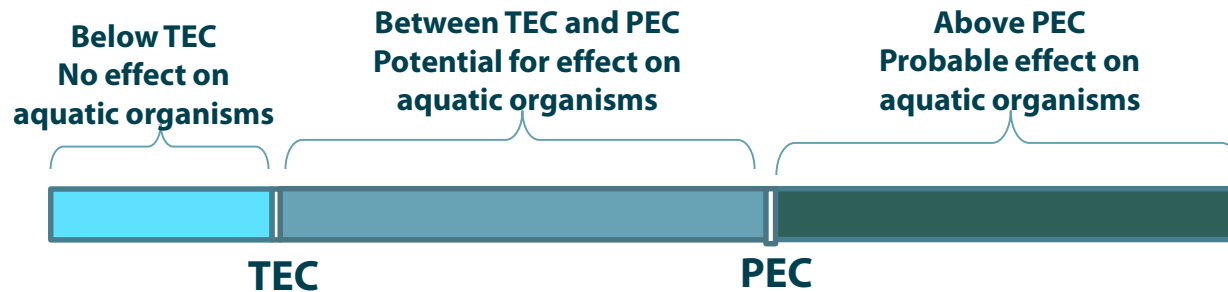
- Total Organic Carbon
- Nitrate+Nitrite (Inorganic Nitrogen)
- Total Kjeldahl Nitrogen (Organic Nitrogen)
- Phosphorus
- Sulfur

Metals

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc

Sediment Data Analysis

- Results of chemical testing were compared to freshwater sediment guidelines
 - Values derived by scientific community based on real world sediment concentrations
 - Each chemical has two values:
 - A threshold effect concentration (TEC)
 - A probable effect concentration (PEC)



- An “effect” means that an organism’s behavior is impacted, such as a slow down of organism growth rate
- “Effects” do not indicate mortality

Sediment Results

- Sediment Type
 - Pearce Creek Lake sediments were mostly silts and clays
 - Elk River monitoring location was sandy
 - Elk River reference location was silty with a lot of shell material
- Nutrients and Metals
 - Nutrient concentrations naturally variable at all locations
 - Overall, concentrations of nutrients and metals were lower in the Elk River sediments
→ Elk River locations had higher percent of sand and contained substantial shell material



Elk River Connecting Channel – Elk River Outlet at High Tide



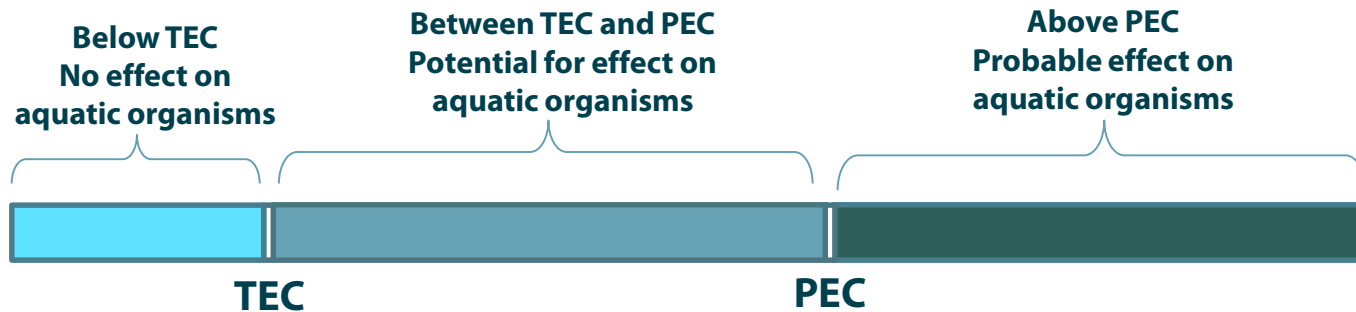
Elk River Connecting Channel – Elk River Outlet at Low Tide

Sediment Chemical Screening

- Chemical Screening

- For Pearce Creek Lake monitoring locations, 5 metals were between the TEC and PEC, and nickel exceeded the PEC
- For the Pearce Creek Lake reference location, 2 metals were between the TEC and the PEC, and nickel exceeded the PEC
- For Elk River monitoring location, 6 metals were between the TEC and PEC, none of the metals exceeded the PEC
- For Elk River reference location, 2 metals were between the TEC and PEC, none of the metals exceeded the PEC

Nickel concentrations are generally consistent with sediment in other parts of the Chesapeake Bay region



Benthic Bioassays

- 10-day whole sediment toxicity testing using *Hyallela azteca* : freshwater amphipod (laboratory cultured)
- Standard testing procedure commonly used to evaluate sediment conditions
- Amphipods are added to sediment collected from each sampling location
- 8 replicates tested for each location x 10 organisms per replicate = 80 organisms
- Measure survival and organism growth



Benthic Bioassay Results

- Compared results for each location to reference site
 - Pearce Creek Lake monitoring locations (PCL-01 to PCL-07) compared to Pearce Creek Lake reference (PCL-REF)
 - Elk River monitoring location (ER-01) compared to Elk River reference (ER-REF)
- Results
 - Survival high for the Pearce Creek Lake and Elk River sediments
 - Sediments are not toxic, and support benthic organisms



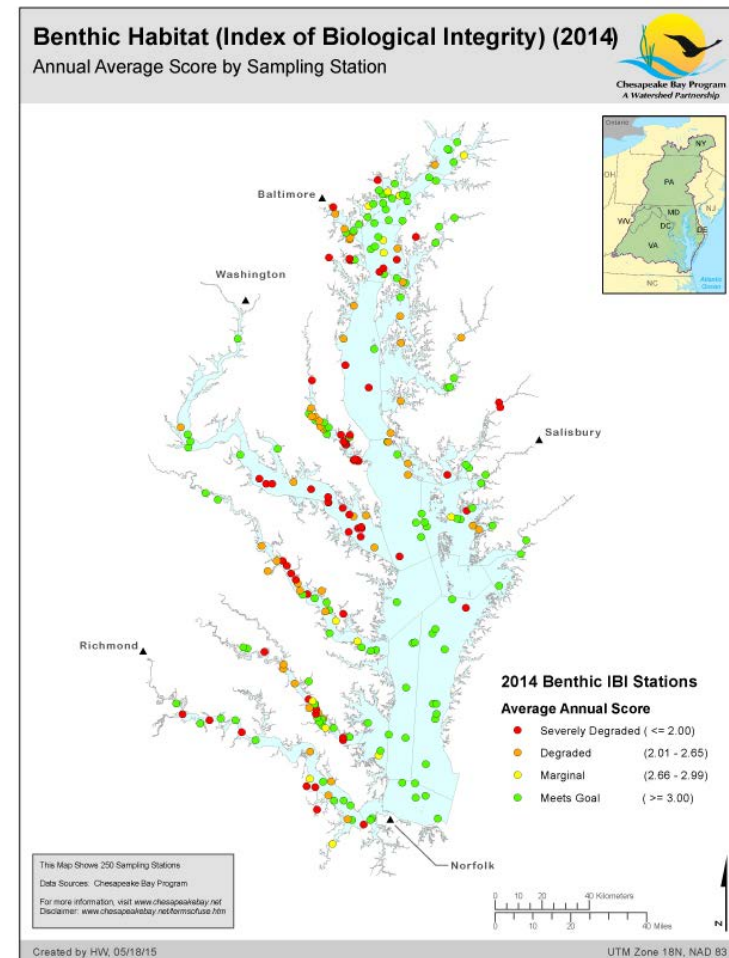
Benthic (Bottom Dwelling) Community

- Biological characterization of sediments included benthic community sampling
 - Benthics are bottom-dwelling organisms, such as worms, insects, amphipods, and clams
 - Are an important part of the diet for fish and birds
 - Commonly used as indicators of environmental stressors because they live in the sediment and can't move away
- Extensively used throughout the Chesapeake Bay
 - Bay Program has developed a standard set of measurements, or metrics, used to determine if benthic community is healthy
 - 12 different metrics are calculated for each location



Benthic (Bottom Dwelling) Community

- Several of the metrics are combined into a value called the Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI)
 - Takes into account salinity and sand or silt
 - Allows for direct comparison between sites throughout the Bay
- Can be influenced by natural conditions (i.e. low dissolved oxygen, low total organic carbon) or a response to poor sediment quality
- Based on results, locations are classified as:
 - Meets Restoration Goal
 - Marginal
 - Degraded
 - Severely Degraded



Benthic (Bottom Dwelling) Community

- Benthic organisms collected using a grab sampler
- Three replicate grabs were collected from each location and sieved on the boat
- Organisms were transferred to cloth bags and preserved immediately after collection
- At the laboratory, microscope analysis is used to identify all the species for each replicate
 - Often hundreds of organisms per replicate
- For each location, the result is a sum of all the species identified in each replicate



Benthic Community Results

- Pearce Creek Lake
 - The Pearce Creek Lake reference location met the Chesapeake Bay restoration goal
 - Six of the Pearce Creek Lake locations met the Chesapeake Bay restoration goal
 - One Pearce Creek Lake location (PCL-07) was classified as severely degraded
- Elk River
 - The Elk River reference site was classified as severely degraded, primarily because of the overabundance of one species
 - The Elk River monitoring location was classified as marginal



Exterior Monitoring Schedule

- This is the initial round of exterior monitoring in Pearce Creek Lake and the Elk River
- A spring baseline sampling event will occur in the April / May 2016 timeframe
- Additional baseline monitoring will occur in Fall 2016 and Spring 2017
- Establish the “existing” condition for water, sediment, and benthic community
- Once dredged material placement starts, monitoring will continue and results will be compared to the baseline data



Questions/Discussion

