PEARCE CREEK DREDGED MATERIAL CONTAINMENT FACILITY EXTERIOR MONITORING PROGRAM FALL 2015 BASELINE SAMPLING RESULTS

The Pearce Creek Dredged Material Containment Facility (DMCF) is located on Maryland's Eastern Shore in the northern portion of the Chesapeake Bay, just east of the Elk River (Figure 2). The Pearce Creek DMCF was constructed in the mid-1930s for placement of dredged material from the southern approach channels to the Chesapeake and Delaware Canal. The DMCF is owned by U.S. Army Corps of Engineers Philadelphia District and was operational until 1993.

Existing placement sites for dredged material from the Chesapeake Bay are limited; therefore, there is a long-term dredged material placement capacity shortfall resulting in a need to study, select, and implement new options capable of accepting the annual maintenance dredged material. Reactivation of the Pearce Creek DMCF to accept placement of dredged material is one component of the Dredged Material Management Plan (DMMP) for the Chesapeake Bay Federal Navigation Channels. Reactivation was approved by Maryland Department of the Environment (MDE), pending the completion of site improvements. Rehabilitation and repair of the existing Pearce Creek DMCF, including the installation of a geotextile liner, is ongoing and will be completed before the site accepts additional dredged material.

The Maryland Port Administration (MPA) is conducting the Pearce Creek DMCF Exterior Monitoring Program in an effort to establish baseline aquatic environmental conditions around the DMCF. The Pearce Creek DMCF Exterior Monitoring Program consists of collecting sediment quality, surface water quality, benthic community, and benthic bioassay samples from the Pearce Creek Lake and the Elk River. Baseline information will be used to identify if there are any trends or changes in the aquatic environment in the vicinity of the Pearce Creek DMCF as a result of facility operations (i.e., placement of dredged material and the discharge of surface water through the spillways). Water discharges from the DMCF during operations will be conducted in accordance with a permit, known as a Water Quality Certification, issued by MDE.

A total of four baseline sampling events—fall 2015, spring 2016, fall 2016, and spring 2017—will be conducted. Dredged material placement at the Pearce Creek DMCF is currently planned to start in fall of 2017. Future monitoring events for Pearce Creek DMCF Exterior Monitoring Program will include post-dredged material placement sampling in the fall of 2017 and spring of 2018. The frequency of monitoring events beyond those planned through the spring of 2018 will be determined as needed through the adaptive management process.

This data summary details the results of the fall 2015 baseline monitoring event, which was conducted in September 2015. The baseline monitoring event included sediment quality, surface water quality, benthic community (animals that live in the bottom sediment, such as worms, clams, and insects), and

sediment bioassay sample collection from seven monitoring locations and one reference location in Pearce Creek Lake, and one monitoring location and one reference location in the Elk River (Figure 2).

Reference locations measure natural changes in background conditions, and are located in areas that will remain outside of the influence of the DMCF operations. Results from the reference locations are compared to the results from the monitoring locations to evaluate if inputs from the surrounding watershed may be influencing conditions in Pearce Creek Lake or the Elk River.

SEDIMENT QUALITY

The physical and chemical characteristics of ten sediment samples from the Pearce Creek DMCF exterior monitoring locations were assessed to determine the sediment quality and baseline sediment conditions. Sediments were sent to a laboratory and tested for grain size, metals, nitrogen, phosphorus, sulfur, and organic carbon. This list was chosen because it represents the composition of soils that erode from the surrounding area, which are the source for the majority of the Pearce Creek Lake sediments.

Sediment quality guidelines are used to identify potential chemicals of concern in aquatic ecosystems. The threshold effect concentrations (TEC) are chemical concentrations below which adverse effects on organisms are unlikely. Probable effects concentrations (PEC) represent concentrations above which adverse effects on organism are possible. Concentrations that are between the TEC and PEC represent the concentrations at which adverse effects on organisms may occur, as shown below:

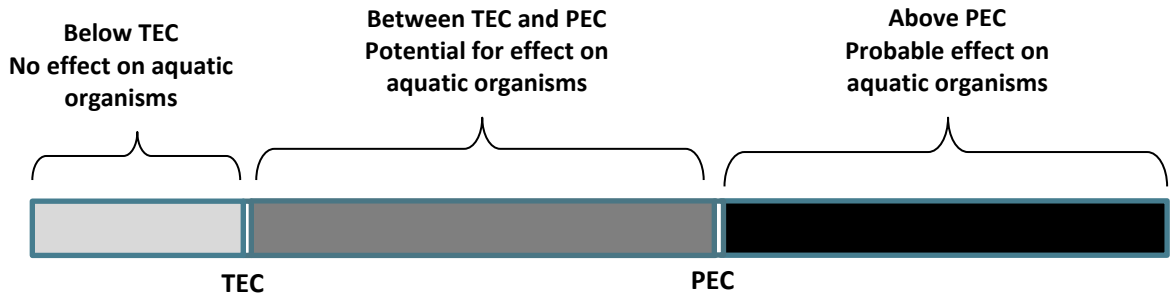

FIGURE 1. DATA EVALUATION USING SEDIMENT QUALITY GUIDELINES

Comparisons of chemical concentrations in sediment from the Pearce Creek Lake monitoring locations to the TECs and PECs indicated that six metals were detected at concentrations between the TEC and PEC, and only nickel was detected at a concentration that exceeded the PEC value. Nickel exceeded the PEC for both the Pearce Creek Lake monitoring locations and the reference site. Nickel is typically detected at concentrations that are slightly above the PEC throughout the Chesapeake Bay region due to f the underlying geology in the area. Nickel concentrations will continue to be evaluated in subsequent baseline sampling events.

Comparisons of chemical concentrations in sediment from the Elk River monitoring location to the TECs and PECs indicated that two metals—nickel and zinc—were detected at concentrations that were

between the TEC and the PEC, and all of the other tested metals were detected at a concentration below TEC values. For both nickel and zinc, the concentrations detected at the Elk River reference site were slightly higher than concentrations detected at the monitoring location.

WATER QUALITY

The physical and chemical characteristics of ten water samples from the Pearce Creek DMCF exterior monitoring locations were assessed to determine surface water quality and baseline surface water conditions. Chemicals detected in the surface water were compared to water quality standards and criteria developed by the US Environmental Protection Agency (USEPA) and the State of Maryland for freshwater environments. Each chemical has two criteria – one that evaluates short term, or acute, effects and one that evaluates long term, or chronic, effects.

Eight surface water samples were collected from Pearce Creek Lake, and two surface water samples were collected from the Elk River (Figure 2). In addition to measuring the surface water conditions when the samples were collected – such as water temperature, oxygen content, and water clarity (turbidity) – the surface water samples were also sent to a laboratory. Laboratory tests for the water samples included metals, phosphorus, and suspended solids. This list was chosen it represents the composition of surface water runoff and soil erosion, which provide the majority of the surface water that flows into Pearce Creek Lake from the surrounding area.

For the Pearce Creek Lake samples, 11 of the 16 tested metals were detected in the surface water samples. Concentrations for the metals were generally low, and consistent with metal concentrations at the upstream reference site. Zinc was the only metal in the Pearce Creek Lake surface water samples that was above the water quality criteria. Zinc concentrations were above the criteria for only one location (05). Zinc concentrations will continue to be monitored during subsequent baseline events.

For the Elk River samples, eight of the 16 tested metals were detected in the surface water samples. Concentrations for the metals were generally low, and consistent with metal concentrations at the offshore reference site. All of the metals in the Elk River surface water samples were well below the freshwater criteria.

BENTHIC COMMUNITY

Benthic organisms (animals that live in the bottom sediment such as worms, clams, and insects) are important indicators of environmental stress in aquatic systems because they don't move very far during the course of their lifetime. Therefore, benthic organisms act as a record of the environmental conditions in a specific area over a long period of time. Benthic invertebrates are also important food for many species, and in healthy ecosystems a robust and diverse benthic community provides food to many other animals.

To characterize the benthic communities in Pearce Creek Lake and the Elk River, several components of the community were calculated and used to determine the Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) at each location. The Chesapeake Bay B-IBI is a tool developed by EPA's Chesapeake Bay program that combines many different indicators that describe the condition of the benthic community. Some examples of the indicators used to calculate the Chesapeake Bay B-IBI are the total number of species, the abundance (total number of organisms), and diversity (how many different species are present).

The Chesapeake Bay B-IBI is used to determine if the community is healthy (meets the goal), stressed (marginal), or in poor condition (degraded or severely degraded). For the fall 2015 sampling event, the Chesapeake Bay B-IBI for the Pearce Creek Lake and Elk River monitoring and reference locations indicated the following:

- Six of the Pearce Creek Lake monitoring locations (01, 02, 03, 04, 05, and 06) met the Chesapeake Bay goal.
- One Pearce Creek Lake monitoring location (07) was severely degraded because only a few organisms were present at this location, therefore, the benthic abundance was low.
- The Pearce Creek Lake reference location met the Chesapeake Bay goal.
- The Elk River monitoring location was classified as marginal.
- The Elk River reference site was severely degraded, primarily because of the overabundance of one species, so the benthic diversity at this location was very low.

Benthic community conditions can change as a result several environmental factors, including changes in water temperature and salinity. Information from the baseline monitoring event in the spring will provide additional information to evaluate overall conditions.

BENTHIC BIOASSAYS

Benthic bioassays are standard laboratory tests designed to tell if the sediment from each sampling location is acutely toxic to benthic organisms by measuring the survival of organisms in the sediment after a set amount of time. For the Pearce Creek DMCF bioassays, a species of freshwater amphipod (a small crustacean that is typically found in sediments throughout the Chesapeake Bay) was used in the bioassays, and survival was measured after the amphipods had lived in the sediment for 10 days. After the tests were completed, statistical analyses were performed to determine if exposure to the Pearce Creek Lake and Elk River sediment samples was low.

Survival of the amphipods in the Pearce Creek Lake sediment and the Elk River sediment was high. For the seven sediment samples from Pearce Creek Lake ranged from 91 to 100%, and survival for the test sediment from the Elk River was 94%. Therefore, the sediments collected from Pearce Creek Lake and the Elk River were not acutely toxic, and the sediments are unlikely to cause adverse effects to benthic organisms.

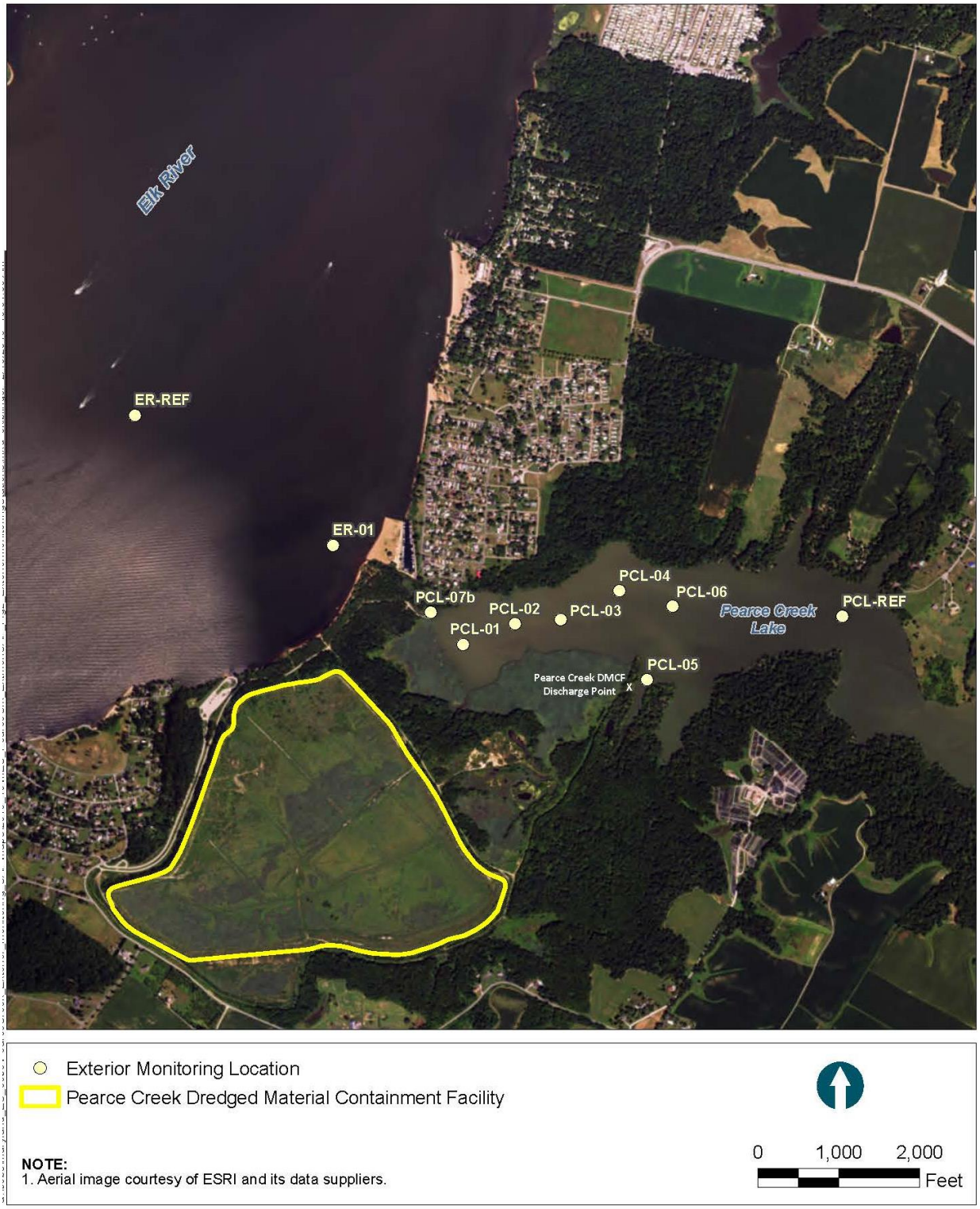

Figure 2
Exterior Monitoring Locations
Sampling and Analysis Plan
Pearce Creek DMCF Exterior Monitoring Program