



**Revised Baseline Ecological
Evaluation of the Former Delphi
Interior and Lighting Systems Site,
Trenton, New Jersey**

Prepared for

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Tables are presented at the end of the main text.

Acronyms and Abbreviations

BEE	baseline ecological evaluation
COPEC	contaminant of potential ecological concern
GM	General Motors
HQ	hazard quotient
NAWC	Naval Air Warfare Center
NJDEP	New Jersey Department of Environmental Protection
PAH	polycyclic aromatic hydrocarbon
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
VOC	volatile organic compound

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Introduction

The Inland Fisher Guide Division of General Motors (GM) historically operated a facility in Trenton, New Jersey. The Site has been referred to in the past by several names and is referred to as the Former Delphi Interior and Lighting Systems Site (Site) for the State of New Jersey Industrial Site Recovery Act (ISRA) Remedial Investigation. The Site is closed, and all buildings and other structures have been demolished. Currently the Site consists of a large concrete pad where the former buildings stood, the original paved parking lots, and undeveloped areas around the eastern and southern borders of the property (Figure 1). The entire property is surrounded by chain link fencing.

A small stream, Gold Run, runs through the eastern portion of the Site (Figure 1) and continues approximately 2 miles to its confluence with the Delaware River. A dam constructed in the upper section of Gold Run has created a 0.9-acre pond on the property (Figure 1), termed Gold Run Pond in this report. A swale (referred to as the Southern Swale in this report) extends along the southern boundary of the Site and intersects with Gold Run just upstream from the point at which Gold Run runs off the property (Figure 1). The only areas at the Site that offer habitat for ecological receptors are Gold Run, Gold Run Pond, the Southern Swale, and the upland areas that are adjacent to these features.

In accordance with the *Technical Requirements for Site Remediation, N.J.A.C. 7:26E* and to comply with the New Jersey Department of Environmental Protection (NJDEP) 1998 *Guidance for Sediment Quality Investigations*, GM contracted with Exponent to prepare a Baseline Ecological Evaluation (BEE) of the Site. The BEE was prepared following the NJDEP Site Remediation Program's approach. The original BEE was submitted in December 2003. The NJDEP Bureau of Northern Case Management provided comments on the BEE in November 2005. This revised BEE was prepared to address those comments and to update the evaluation to include additional data collected during 2004 and 2006, and legacy data (1994, 1998) that were added to the database subsequent to the 2003 BEE. The BEE addresses Gold Run, Gold Run Pond, the Southern Swale, and upland areas that are adjacent to these features. The BEE is consistent with the specifications and requirements of NJDEP for conducting such an evaluation, and includes the following major elements:

- **Identification of contaminants of potential ecological concern (COPECs)**—Existing data for the Site were reviewed and a list of COPECs was prepared for three environmental media: surface water, sediment, and soil. The COPECs were those that exhibited the ability to biomagnify or bioaccumulate in food webs, as well as those with Site concentrations that exceeded applicable standards, criteria, and guidelines specified by NJDEP.
- **Identification of sensitive natural resources**—A Site visit was conducted to determine whether environmentally sensitive natural resources are located within the Site boundaries or immediately adjacent to the Site. The location of each sensitive area was determined with respect to any contaminated portions of the Site, and the size of each area was estimated. In addition to

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the Site visit, the New Jersey National Heritage Program was contacted and the NJDEP geographic information system database was reviewed to collect information on sensitive natural resources.

- **Identification of potential contaminant migration pathways**—The Site visit was also used to determine whether any potential migration pathways exist by which contaminants can reach sensitive natural resources. In addition, any observations of potential impacts on the sensitive natural resources were identified, including (but not limited to) stressed or dead vegetation; discolored soil, sediment, or surface water; unexpected absence of biota; and presence of seeps or discharges.
- **Evaluation of the need to conduct further investigations**—Based on the information obtained from the literature, historical data, and the Site visit, the need for additional ecological investigations was determined.

The Site was visited on April 4, 2002, by Dr. Scott Becker, and on September 29, 2006, by Linda Ziccardi, both ecologists with Exponent. Mr. David Worrell of GM admitted Dr. Becker to the Site and provided him with a tour and account of the Site history. John Behrle, a former employee of GM at the Site and currently employed by Haley & Aldrich, accompanied Ms. Ziccardi on the 2006 Site visit.

In addition to information obtained during the 2002 and 2006 Site visits, several sources of data or information were evaluated. GM has been collecting information on chemical concentrations in surface water, sediment, and soil at the Site since 1994, all of which are described in the Remedial Investigation Report, Addendum (December 2003) and subsequent responses to NJDEP comments (October and December 2006). In 1993, an *Environmentally Sensitive Areas Protection Plan* (Gannett Fleming 1993) was prepared for the Site as part of GM's discharge cleanup and removal plan, as required by NJDEP. Gannett Fleming conducted a Site visit on May 5–6, 1993, to support this effort. Finally, a Site investigation was conducted by EA (2000) under contract to the U.S. Navy, to evaluate the extent to which upstream discharges from the Naval Air Warfare Center (NAWC) may have affected the Gold Run System, including portions of the Former Delphi Interior and Lighting Systems Site.

For the purposes of this BEE, the Gold Run System on the Site was subdivided into the following segments of aquatic habitat (Figure 1):

- **Upper Gold Run**—From the northern boundary of the Site to Gold Run Pond
- **Gold Run Pond**—The entire pond, onsite
- **Lower Gold Run**—From the dam below Gold Run Pond to the southern boundary of the Site
- **Southern Swale**—The entire drainage swale between the elevated railroad siding south of the Site and the southern property line.

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The remainder of this report consists of the following major sections:

- **Site Setting**—Describes key characteristics of the Site and surrounding areas, as well as results from the April 4, 2002, and September 29, 2006, Site visits
- **Overview of NAWC Facility and Studies**—Presents an overview of activities related to the closure of this facility
- **Summary of Environmentally Sensitive Areas Protection Plan**—Presents a summary of the relevant findings of this study
- **Sensitive Habitats near the Site**—Identifies any sensitive habitats located on or immediately adjacent to the Site, as well as those downstream that may be exposed to Site-related contaminants
- **Screening of Chemical Contaminants in Environmental Media**—Presents results of chemical screening analyses conducted for samples of surface water, sediments, and soil collected at the Site
- **Summary**—Presents an overall summary of the information evaluated in the BEE.

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Site Setting

This section describes the general characteristics of the Site and surrounding areas, as well as the results of the Site visits conducted on April 4, 2002, and September 29, 2006. The Site occupies approximately 80 acres in a largely residential/commercial area in Ewing Township, Mercer County, New Jersey. A land use and drainage map of the Site was prepared by Gannett Fleming (1993) and is presented in Appendix A (Figure A-1). The Site is located in a suburban area approximately 5 miles northwest of Trenton, New Jersey, and 30 miles northeast of Philadelphia, Pennsylvania. It is bordered by Parkway Avenue to the north, Silvia Avenue (a gravel road) to the east, and railroad tracks to the west (Conrail) and south (CSX) (see Figure 1). Located diagonally across Parkway Avenue from the Site to the northwest is the former NAWC facility, which closed in 1998 and has subsequently been the subject of several environmental investigations conducted by the U.S. Navy (discussed herein). Gold Run traverses the east side of the property and flows south. The majority of the central and western portions of the Site are covered with pavement or concrete where the Former Delphi Interior and Lighting Systems Plant and parking lots were located. Forested and otherwise vegetated areas exist along the southern and eastern Site boundaries, including the riparian zone around Gold Run.

Downstream (i.e., south/southwest) from the Site, the surrounding areas are primarily residential, light-industrial, and agricultural. A large portion of the land between the Site and the Delaware River is owned by the State of New Jersey and occupied by the Marie S. Katzenbach School for the Deaf. A large tract of land near the mouth of Gold Run (at the confluence with the Delaware River) is occupied by the Trenton Country Club.

Gold Run System

This section describes the various components of the Gold Run System, including Gold Run and Gold Run Pond. Gold Run originates at springs north and west of Site and its flow is conveyed underground by drainage pipe. These underground pipes also carry storm water from parking lots and Parkway Avenue, upstream of the Site. The Gold Run System receives drainage from several drainage areas unrelated to the Former Delphi Interior and Lighting Systems Site, including the former NAWC facility, the area west of DeCou Avenue, the area south of Parkway Avenue, the shopping center east of the NAWC facility (across Parkway Avenue from the Site), and the drainage area east of NAWC that discharges directly to the Pond (EA 2000). Based on information obtained from historical aerial photos and topographic maps, Gold Run has been significantly modified from its original, pre-development state. In addition to the installation of the dam that creates Gold Run Pond, the creek has been straightened from its original course.

The 2002 and 2006 Site visits were conducted during periods of relatively low flow. Overall, the visits showed that Gold Run was generally 6–13 ft wide and less than 1.5 ft deep throughout. The characteristics of the streambed were relatively uniform, consisting of areas of cobbles interspersed with areas of soft sediments. A substantial amount of algal growth was found on the cobbles in some areas. The riparian zone was generally vegetated with hardwood

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trees or shrubs and there were no areas of eroding banks or other kinds of damaged riparian areas. No areas were observed along Gold Run that were characterized by stressed or dead vegetation; discolored water, sediment, or soil; seeps; or discharges, other than the two storm drains that form the headwaters of Gold Run (Figure 2) and the two storm drains that discharge to Gold Run Pond (Figure 3).

Evidence of wildlife was found at the Site, including woodchuck holes, raccoon trails, and deer trails along the stream banks. Several Canada geese (*Branta canadensis*) were observed using the fields on the Site. In addition, one goose was observed loafing on Gold Run Pond, a female goose was observed nesting on the banks of the pond during the 2002 Site visit, and a great blue heron was observed at the pond during the 2006 Site visit. John Behrle of Haley & Aldrich provided anecdotal evidence of foxes using the Site.

Upper Gold Run

Upper Gold Run begins at the northern boundary of the Site, where two stormwater systems discharge from under Parkway Avenue through separate outfalls (Figure 2). During the 2002 and 2006 Site visits, flow from these outfalls was relatively low. The first stormwater system (the left outfall, as shown in Figure 2) is composed of pipelines that run along both sides of Parkway Avenue. The northern pipeline originates near the former NAWC facility and historically received storm water from the NAWC facility through four separate outfalls. The southern pipeline contains discharges from drainage areas to the west of the Site, including a remnant headwaters area, the Ancestral West Branch (see Figure 1). The second stormwater system (the right outfall shown in Figure 2) originates in a wetland referred to as Ancestral Gold Run (see Figure 1) and it receives drainage from soccer fields and a shopping center located across Parkway Avenue from the Site. In addition, the former Delphi building's eastern roof drains and driveway drained to a storm sewer that empties into Gold Run near its origin. Because the building is no longer there, the roof drains are no longer in use; however, catch basins in the driveway and remnants of the downspouts continue to contribute to this drain during precipitation events. No flow was observed from this outfall during the Site visits; however, anecdotal information indicates that periodic low flow from this drain still occurs.

Upper Gold Run is included as part of Investigation Area 11. The riparian zone of Upper Gold Run is composed largely of dense shrubs and hardwood trees, interspersed with areas of grass and forbs, including some areas that are mowed near Gold Run Pond.

Gold Run Pond

In the 1950s, GM constructed a dam on Gold Run approximately 440 ft downstream from its origin, forming Gold Run Pond (Figure 3). The pond was constructed to provide a water reservoir for fighting fires. Gold Run Pond occupies approximately 0.9 acres and has a maximum depth of approximately 6.5 ft. However, depths throughout most of the pond are 1.5 ft or less (EA 2000). Two stormwater outfalls discharge to the eastern edge of the pond (Figure 3) and contain drainage from areas east and north of the Site.

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Investigation Area 11 includes Gold Run Pond, the surrounding riparian area, and the upland area between Gold Run and the eastern property line (see Figure 10). A former recreational field located in the northeast corner of the lot was sold and is not included in this BEE.

On behalf of the U.S. Navy for the NAWC facility investigation, EA (2000) sampled fishes in Gold Run Pond on October 20, 1999, using electrofishing methods for 70 minutes. Individuals of three species were captured: brown bullhead (*Ameiurus nebulosus*), golden shiner (*Notemigonus crysoleucas*), and creek chub (*Semotilus atromaculatus*). Twenty-six brown bullheads, 103 golden shiners, and 1 creek chub were captured. No predatory (i.e., piscivorous) fishes were found in the pond. The largest individuals of each species were retained for chemical analysis and included four bullheads (175–192 mm total length), three golden shiners (102–135 mm total length), and the single creek chub (123 mm total length). EA (2000) concluded that, although the catch per unit effort was relatively high for the fish community in the pond, the species richness was very low. No studies of fishes have been conducted in Upper or Lower Gold Run.

Lower Gold Run

Below the Gold Run Pond dam, Lower Gold Run continues approximately 1,300 ft to the southern boundary of the Site. The stream gently meanders through a hardwood forest and has relatively well developed banks and riparian vegetation throughout (Figure 4). At the southern boundary of the Site, the stream flows through a tunnel under the CSX railroad tracks, which are located on a steep bank that extends along the entire southern boundary of the Site. Immediately before leaving the Site, Lower Gold Run receives drainage from the Southern Swale (Figure 5), which is approximately 3 ft wide and very shallow.

Investigation Area 10 includes the riparian forested area along Lower Gold Run (downstream of the Area 9 Parking Lot Drain Outfall), and the lower portion of the Southern Swale where the swale meets Gold Run.

Southern Swale

The Southern Swale flows along most of the southern boundary of the Site and is bordered by shrubs and grasslands throughout (see Figure 1). This swale receives water from the storm drain running along the western property boundary (formerly receiving roof runoff), runoff from the driveway and seepage from the retaining wall drains at the base of the wall that supports the elevated railroad tracks west of the Site. The upper portion of the swale is unlined. The middle segment of the swale is lined with concrete, is intermittently dry, and provides no viable aquatic habitat (Figure 6). The lower parts of the Southern Swale are unlined and provide a limited amount of aquatic habitat that is marginal in quality. During the September 2006 Site visit, clearing of vegetation along portions of the Swale was being conducted by CSX for maintenance of the railroad right-of-way.

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The Southern Swale includes portions of Investigation Areas 6, 7, and 8. The Area 6 portion of the swale lies south of the parking lot, Area 7 lies south of the Die Storage Area, and Area 8 includes the swale downstream of Stormwater Outfall DSN003A.

Downstream Areas

After Gold Run leaves the property through a tunnel under the CSX railroad tracks, it flows through a wooded ravine. A housing development is located on the eastern side of the ravine, and a housing condominium development and light industrial activities are located on the western side. The former Roller Bearing facility (a known contaminated site [Site ID 6587]) was located along the western side of this stretch of Gold Run. The stream then flows onto the property of the School for the Deaf, where two ponds have been created by the construction of dams. The lower dam is relatively large (Figure 7) and creates an extensive pond behind it. This dam forms an effective barrier to fish migration from the Delaware River and lower segments of Gold Run to the ponds and upper segments of Gold Run, including those on the Site. Near its mouth, Gold Run flows through a tunnel under a highway and enters a delta that merges with the Delaware River (Figure 8).

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Overview of NAWC Facility and Studies

The NAWC facility operated until 1998. It encompasses 66 acres and was used to test aircraft engines under simulated working temperature, pressure, and other atmospheric conditions found at altitudes (EA 1997). Facilities included an industrial wastewater treatment plant, a cooling tower complex, hazardous waste storage areas, aboveground storage tanks, and a test facility that was used to simulate atmospheric temperature and pressure.

A series of investigations have been conducted by the U.S. Navy to evaluate chemical contamination both on and downstream from the NAWC facility. The Navy identified five metals as chemicals of concern that may have affected the Gold Run System as a result of discharges from the NAWC facility: aluminum, chromium, lead, mercury, and zinc (IT 1994). The main pathway from the NAWC facility to Gold Run was through one of the two storm sewers that form the headwaters of the stream. Following additional investigations of the storm drainage system from the NAWC facility in 1997, concentrations of all five metals were found to be elevated in the system. In particular, mercury was found in NAWC storm drains at elevated levels that were unique to the facility. As a result, additional cleanup activities were conducted by the Navy between March 1998 and November 1999 to mitigate discharges to Gold Run. Monitoring conducted by the Navy in 1999 following the cleanup activities indicated that the NAWC onsite storm sewers no longer represented a source of mercury to Gold Run and Gold Run Pond (EA 2000).

Following the additional cleanup activities conducted by the Navy at the NAWC facility, in 1999 EA, on behalf of the U.S. Navy, conducted an ecological evaluation of surface water, sediments, and fishes in Gold Run and Gold Run Pond. This study was conducted to address concerns related to the potential influence of NAWC drainage on the Gold Run System. EA collected surface water samples at six stations distributed throughout Gold Run Pond and at a single station in Upper Gold Run. Surface sediment samples were collected by EA at six stations distributed throughout Gold Run Pond, at one station located in Upper Gold Run, and at one station located in Lower Gold Run, approximately 650 ft downstream from the pond. Additional sediments from three of the stations in Gold Run Pond were collected by EA for laboratory bioaccumulation analysis of TAL metals using the 28-day test based on the oligochaete *Lumbriculus variegatus*. Fishes were collected throughout the pond for measurement of TAL metals in whole bodies of individuals. The EA (2000) Technical Memorandum provides detailed information on this sampling effort and maps that depict the station locations.

The results of the 1999 NAWC investigation conducted by EA (2000) are presented and discussed later in this BEE.

Summary of the Environmentally Sensitive Areas Protection Plan

As noted previously, an *Environmentally Sensitive Areas Protection Plan* (Gannett Fleming 1993) was prepared for the Former Delphi Interior and Lighting Systems Site in 1993 as part of GM's discharge cleanup and removal plan for the Site. The purpose of the plan was to:

- Identify environmentally sensitive areas that could become impacted by a future discharge of a hazardous material regulated by the Spill Control Act
- Develop a plan to protect any identified environmentally sensitive areas
- Develop a plan to minimize adverse impacts in the event of a spill.

As part of the study, staff from Gannett Fleming conducted a Site visit on May 5–6, 1993, collected pertinent information from NJDEP and other governmental agencies, and evaluated infrared aerial photographs of the study area. The scope of the study area extended 15 miles downstream from the Site along Gold Run and the Delaware River. The actual boundaries of the study area were determined on the basis of the extent of the flood zones for those two water bodies and the watershed for Gold Run.

Although the scope of the study conducted by Gannett Fleming (1993) is much greater than that required for this BEE, it provides a relatively large amount of detailed information for the Site, as well as larger scale information on ambient conditions downstream from the Site. The results of this study are therefore summarized below.

Surface Water

Gannett Fleming identified three surface water bodies within the Site boundaries: Gold Run, Gold Run Pond, and an unnamed intermittent stream/drainage ditch (referred to as the Southern Swale in this BEE). No other surface water features were identified on the Site.

Freshwater Wetlands

According to Gannett Fleming (1993), although 3,090 acres of freshwater wetlands were identified in the overall study area, only a small fraction of this total was located in the immediate vicinity of the Site. The largest wetland in the study area was the Trenton Marsh, located on the Delaware River, southwest of Trenton.

In addition to the work done by Gannett Fleming, Amy S. Green Environmental Consultants, Inc., conducted a verification of wetlands delineation for GM for the Site in May 2005. Several wetland types were identified on the Site. The majority of the onsite wetlands are the forested wetlands that are associated with Gold Run. The Wetlands/Open Waters Investigation

Summary submitted to NJDEP as part of the Request for Letter of Interpretation, Regulatory Line Verification (Green 2006) provides wetlands mapping and details on the vegetation, soils, and hydrology of these wetland areas.

Wildlife Breeding Areas

The overall study area for the Environmentally Sensitive Areas study contained no known colonial water bird nesting areas or forest bird breeding areas. Although confirmed breeding areas for the river otter were identified north of the study area on the Delaware River, Gannett Fleming (1993) concluded that the presence of breeding river otters has not been confirmed in Gold Run, or in any portions of the Delaware River considered in the study.

Gannett Fleming (1993) noted that while suitable nesting habitat for colonial water birds was found in the Trenton Marsh, no evidence of water bird colonies was observed. They also noted that the Trenton Marsh contained suitable habitat for forest bird breeding.

Gannett Fleming (1993) noted that most of the habitat types occurring in the larger study area (including forests, wetlands, and surface water) exhibited evidence of disturbance, such as fill areas, power line and road cuts, siltation, trash, and a high edge to area ratio. They concluded that the observed disturbances likely limit the quality of habitat for wildlife breeding.

Migratory Stopover Areas

The overall study area is not a major migratory stopover area for shorebirds, raptors, or passerines. However, Gannett Fleming (1993) noted that suitable habitat for passerines was found near the Trenton Marsh and that some of the passerines observed during the Site visit may have been in the process of migrating farther north. With the exception of the Trenton Marsh, no other suitable habitat for shorebirds, raptors, or passerines was observed in the study area.

Anadromous Finfish Migratory Pathways

According to information provided by Zich (1977), migratory pathways for alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) have been confirmed in the Delaware River within the larger study area. However, no evidence of the presence of these anadromous fishes in Gold Run was reported.

Forest Areas

Gannett Fleming (1993) concluded that no prime or unique forest types were located in the study area. They also concluded that the absence of these forest types was likely the result of extensive development on potentially suitable soils or the presence of soil types unsuitable for prime forest development.

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Habitats for Endangered Species

Gannett Fleming (1993) identified two types of sites for endangered species within the larger study area. They included priority sites (i.e., New Jersey's best habitats for rare and endangered species and natural communities) and general locations of documented occurrences of rare and endangered species and natural communities. The only two priority sites located in the study area included the Trenton Marsh and the Trenton Boat Launch site.

Natural Areas

Gannett Fleming (1993) concluded that there are no sites in the larger study area included in the Natural Areas System, Natural Areas Register, or Natural Land Trust Landholding programs. One wildlife management area was identified in the study area: the Old Wharf Management Area.

Other Environmentally Sensitive Areas

Based on the May 1993 Site visit and evaluations of aerial photographs and U.S. Geological Survey maps, Gannett Fleming (1993) concluded that no bay islands, barrier island corridors, beaches, or dunes were located in the overall study area. They also noted that no wintering areas for waterfowl, prime fishing areas, estuarine areas supporting submerged vegetation, or shellfish harvesting waters were identified in the study area. They noted further that suitable habitat for wintering areas was not found during the May 1993 Site visit. Finally, Gannett Fleming (1993) noted that neither the Delaware River, nor any of its tributaries in the study area, are identified as wild, scenic, recreational, or developed recreational rivers.

Summary of Findings

Based on the findings of the *Environmentally Sensitive Areas Protection Plan* (Gannett Fleming 1993), it can be concluded that, aside from surface water bodies and freshwater wetlands, there are no unique or sensitive ecological habitats on or near the Site. Although there is evidence that migratory pathways for alewife and blueback herring exist in the Delaware River, these species would not be able to migrate to the Site because of the barrier to migration presented by the dam below the large pond at the School for the Deaf.

Environmentally Sensitive Areas Near the Former Delphi Interior and Lighting Systems Site

Environmentally sensitive areas both on and near the Site were delineated by Gannett Fleming (1993) during the 1993 Site visit and were corroborated during the 2002 and 2006 Site visits conducted by Exponent. In addition, current information provided by NJDEP and the results of the 2005/2006 verification of wetlands delineation conducted by Amy S. Green Environmental Consultants, Inc. on behalf of GM were used to identify and verify these habitats on the Site.

Figures A-2 and A-3 in Appendix A show the environmentally sensitive areas on the Site that were delineated by Gannett Fleming (1993) with respect to both a wildlife habitat and a wetland emphasis, respectively. With respect to wildlife, the Site includes forested areas that potentially can provide limited nesting and foraging habitat for songbirds (Figure A-2). The forested areas are found on either side of Upper and Lower Gold Run, Gold Run Pond, and the Southern Swale. In addition to the forested areas on the Site, Gannett Fleming (1993) identified Gold Run Pond as a potential breeding area for amphibians and waterfowl. The pond also provides limited foraging habitat for waterfowl and piscivores, such as great blue heron. The 2002 and 2006 Site visits conducted by Exponent confirmed that all of these environmentally sensitive areas are currently present at the Site and remain unchanged in spatial extent from those found during the Gannett Fleming 1993 Site visit.

With respect to wetlands, the Site includes forested wetlands on either side of Upper and Lower Gold Run, Gold Run Pond, and the Southern Swale (Figure A-3). These wetland areas are described in the Wetlands/Open Water Investigation Summary as being dominated by the species red maple (*Acer rubrum*) and pin oak (*Quercus palustris*), with a few black gums (*Nyssa sylvatica*), black willows (*Salix nigra*), and box elders (*Acer negundo*) (Green 2006). In addition to the forested wetlands on the Site, Gannett Fleming (1993) identified Upper and Lower Gold Run, Gold Run Pond, and the Southern Swale as potentially sensitive surface waters on the Site.

The 2002 and 2006 Site visits conducted by Exponent confirmed that all of these environmentally sensitive areas are currently present at the Site and remain unchanged in spatial extent from those found in 1993. During the 2006 Site visit, grubbing and clearing of vegetation (consisting of trees and shrubs) along the southern bank of the Southern Swale was being conducted by CSX for maintenance of the railroad right-of-way.

To provide the most current evaluation of environmentally sensitive areas both on and near the Site, Exponent accessed the NJDEP database on this subject. The results of that database search are presented in Figure 9. Figure 9 shows that there are several state or federal designated wetlands located on the Site, as well as upstream and downstream from the Site. Most of Upper and Lower Gold Run and Gold Run Pond and their surrounding forested areas are state and federal designated wetlands. However, the Southern Swale is not considered a designated wetland.

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Two small wetlands are located upstream from the Site (Figure 9). One of those wetlands is designated by the state and the other one is designated by the federal government. These two areas correspond to parts of the ancestral headwaters of Gold Run (Ancestral Gold Run) and are dry during most of the year.

Four state designated wetlands and two federal designated wetlands are located downstream from the Site (Figure 9). The uppermost state designated wetland appears to no longer exist because it is currently the site of a condominium development. The next two downstream state designated wetlands correspond to the ponds on the property of the School for the Deaf.

Exponent contacted the New Jersey Natural Heritage Program regarding the potential presence of rare species on or near the Site. According to the response from the National Heritage Program (see Appendix B), neither the National Heritage database nor the Landscape Project has records for occurrences of rare plant species, rare wildlife species, or rare natural communities on or within 0.25 miles from the Site.

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Contaminant Migration Pathways to Environmentally Sensitive Areas

As part of a BEE, the NJDEP requires an evaluation of the potential for contaminants to migrate from onsite sources to ecological receptors. To complete an exposure pathway, both a contaminant source and a receptor community must be present. An exposure mechanism must also exist that has the potential to result in significant exposure (e.g., ingestion of contaminated media, food-web bioaccumulation). Potential contaminant migration pathways and associated ecological exposure pathways are summarized in this section for aquatic and terrestrial habitats on the Site.

The primary source of contaminants at the Site is the former Plant industrial activity. Chemicals from Site-related sources may be released directly to surface soil and surface water, through percolation and leaching to groundwater, via wind erosion and ground disturbance to the surface of other areas, and via runoff to surface water bodies. Surface water and sediment may become contaminated via direct discharge, surface runoff, and groundwater discharge to surface water.

The presence of contaminants in surface water, sediment, and biota of Gold Run and Gold Run Pond indicates that contaminant migration pathways exist for the Gold Run System. These contaminants may originate from Site-related sources such as runoff and stormwater discharge from the Site, and from offsite sources related to the former NAWC facility and upstream stormwater discharges unrelated to the Site. Ecological receptors may be exposed to contaminants in the Gold Run System through contact with and ingestion of sediment and surface water, and through consumption of plants and prey (e.g., fish and invertebrates). The ingestion pathway is the route of exposure that likely poses the greatest risk. Sediment and soil ingestion may also occur incidentally through surface-water ingestion, foraging activities, and/or prey consumption (e.g., sediment contained in the gut of prey fish).

The former Plant site areas do not provide habitat to support ecological receptors; therefore, there are no contaminant migration pathways to terrestrial environmentally sensitive areas on this part of the Site, and these areas need not be considered further from an ecological risk perspective. Terrestrial habitat on the Site is limited to the forested areas in the riparian zone around Gold Run and Gold Run Pond, and to a more limited extent, along the Southern Swale. Because contaminants were detected in surface soil and sediment collected from these areas, migration pathways for contaminants are likely to exist for these areas.

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Screening of Chemical Contaminants in Environmental Media

In this section, potential COPECs in surface water, sediment, and soil on the Site are evaluated by comparing chemical concentrations with ecologically based screening values, or benchmarks. The primary screening values were those identified by NJDEP (1998a,b). However, if a chemical did not have an NJDEP ecologically based screening value, a search was conducted for available screening values from other sources, primarily U.S. EPA (1991, 1996, 1999) for surface water, the Ontario Ministry of the Environment for sediments (Persaud et al. 1993), and Oak Ridge National Laboratory for soils (Efroymson et al. 1997a,b). For undetected chemicals, one-half the detection limit was compared with the screening values. Chemicals that were not detected in any sample for a given exposure area were not included in the screening process. According to NJDEP BEE guidance, if a detected concentration exceeds the benchmark, further assessment may be warranted due to the potential for adverse ecological effects. For contaminants that biomagnify, concentrations below the screening values do not necessarily allow a chemical to be screened out.

For all screening evaluations, the Site was subdivided into major subsections. The aquatic environments were subdivided into Upper Gold Run, Gold Run Pond, Lower Gold Run, and the Southern Swale. The terrestrial environments bordering Upper Gold Run, Gold Run Pond, and Lower Gold Run were subdivided into Areas 10 and 11 (corresponding to the designations in the remedial investigation report) and the upland areas bordering the Southern Swale were subdivided into Areas 6, 7, and 8 (Figure 10). These are the areas on the Site that are most likely to provide habitat for terrestrial receptors because the majority of the upland portions of the Site are developed (e.g., paved or concrete) and barren ground. It should be noted that while the Southern Swale samples in Areas 6 and 7 were characterized as sediment, this part of the swale is often dry and does not provide habitat for aquatic receptors during periods of low-flow. Swale Area 8 is more frequently wet; however, it should be noted that most of the swale in this area is concrete lined and not natural aquatic habitat.

The screening evaluations were also subdivided into those conducted by GM in 1994/1998 (i.e., surface water, sediment, and soil), 2000 (i.e., soil), 2002/2003 (i.e., sediment and soil), 2004 and 2006 (i.e., sediment), and those conducted by EA (2000) for the Navy in 1999 (i.e., surface water and sediment). For sediments, Site data were confined to those chemical concentrations measured in the surface sediment biologically active zone (0–6 in.; NJDEP 1998b). In addition, to comply with the request by NJDEP, data for underlying sediments sampled in 2004 in Lower Gold Run at a depth of 1 to 1.5 ft were screened to assess the potential for exposure, should streambed scouring occur during high-flow events. For soils, Site data were confined to those chemical concentrations measured in the zone having the highest potential for being contacted by organisms (i.e., 0–1 ft). The results of the screening evaluations are described below.

Surface Water

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Surface water screening evaluations for the 1999 metals data were conducted using dissolved concentrations. For the 1998 metals data, evaluations were conducted using concentrations based on unfiltered water samples, because dissolved concentrations were not measured. The 1998 screening evaluation can therefore be considered conservative.

1998 Data

Table 1 provides the surface water screening evaluation results for samples collected in 1998.

Upper Gold Run

No detected chemicals exceeded surface water screening values in Upper Gold Run in 1998.

Gold Run Pond

Detected concentrations of copper, lead, and mercury exceeded their chronic surface water screening values at Station SW11-6 sampled in Gold Run Pond in 1998. In addition, copper exceeded its acute screening value at this station.

Lower Gold Run

The only detected value that exceeded a screening value for samples collected in Lower Gold Run was that for lead at Station SW11-2.

1998 Summary

Based on the information presented above, it appears that most detected chemical concentrations that were elevated above their screening values were found in the surface water of Gold Run Pond. Copper is considered a surface water COPEC because it was detected at a concentration greater than its acute screening value in the pond. Lead is considered a COPEC, because it was detected at a concentration greater than its chronic screening value. Mercury is also considered a surface water COPEC because it was detected above its chronic screening value in the pond and because it can bioaccumulate in organisms.

1999 Data

Table 2 provides the surface water screening evaluation results for samples collected in 1999. It should be noted that the 1999 sampling was conducted after the Navy conducted cleanup actions at the NAWC facility to mitigate discharges of metals to the storm sewer (refer to section above titled Overview of NAWC Facility and Studies).

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Gold Run Pond

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Only copper and barium were detected in surface water at concentrations that exceeded their chronic screening values at one or more of the six stations sampled in Gold Run Pond in 1999. In addition, copper slightly exceeded its acute screening value at four of the six stations.

1999 Summary

Based on the information presented above, copper is considered a surface water COPEC, because it was detected at a concentration greater than its acute screening value at multiple stations in Gold Run Pond. Barium is also considered a surface water COPEC, because it was detected at concentrations in excess of its chronic screening value.

Overall Surface Water Summary

Based on the results of the screening evaluations conducted for surface water at the Site, it can be concluded that surface water contamination does not appear to be widespread. However, copper is considered a COPEC, because it exceeded its acute screening value at several stations. Barium and lead are considered surface water COPECs, because they were detected at concentrations in excess of their chronic screening values. In addition, mercury is considered a COPEC, because it exceeded its chronic screening value at one station in Gold Run Pond and because of concerns regarding its bioaccumulation potential. However, mercury and lead were COPECs in only the 1998 data set and were likely eliminated as a result of cleanup activities undertaken upstream by the U.S. Navy on the NAWC facility.

Sediments

1994/1998 Data

Upper Gold Run

Table 3 provides the sediment screening evaluation results for samples collected in Upper Gold Run in 1994/1998.

A number of metals exceeded their sediment screening values in Upper Gold Run during the 1994/1998 sampling. The greatest exceedances based on mean concentrations were for chromium, copper, and zinc. The mean concentrations of lead and mercury were also relatively high (i.e., close to the upper screening value). Based on single stations, chromium, copper, lead, nickel, and zinc also exhibited relatively high exceedances at Station S11-8, and copper and mercury exhibited relatively high exceedances at Station S11-7.

Several polycyclic aromatic hydrocarbon (PAH) compounds and both of the Aroclors[®] evaluated also exceeded their sediment screening values in Upper Gold Run in 1994/1998.

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Gold Run Pond

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Table 4 provides the sediment screening evaluation results for samples collected in Gold Run Pond in 1994/1998.

A number of metals exceeded their sediment screening values in Gold Run Pond during 1994/1998. The greatest exceedance based on mean concentrations was found for chromium. Based on single stations, chromium and copper also exhibited relatively high exceedances at Station SS-11-SD-3. In addition, concentrations of mercury at two stations (S11-3 and S11-6) were relatively high (i.e., close to the upper screening threshold).

Several PAH compounds and Aroclor[®] 1260 had detected concentrations that exceeded their sediment screening values in Gold Run Pond in 1994/1998. The relatively high (i.e., above the upper screening threshold) exceedance for Aroclor[®] 1260 was found at a single station (Station S11-6-SD-3).

Lower Gold Run

Table 5 provides the sediment screening evaluation results for samples collected in Lower Gold Run in 1994/1998.

A number of metals exceeded their sediment screening values in Lower Gold Run during the 1994/1998 sampling events. The greatest exceedance based on mean concentrations was found for mercury, which exceeded the upper screening threshold. Based on single stations, chromium also exhibited a relatively high exceedance at Station S11-2.

Several PAH compounds exceeded their sediment screening values in Lower Gold Run in 1994–1995. However, none of the exceedances was relatively high. An exceedance of the upper screening threshold for Aroclor[®] 1260 was found at a single station (Station SS-11-SD-5).

Areas 6 and 7 of the Southern Swale

Table 6 provides the sediment screening evaluation results for samples collected in Areas 6 and 7 of the Southern Swale in 1994/1998.

A number of detected metals exceeded their sediment screening values in Areas 6 and 7 of the Southern Swale during the 1994/1998 sampling events. The greatest exceedances based on mean concentrations were for copper, nickel, and zinc.

1994/1998 Summary

Based on the information presented above, it appears that most elevated sediment chemical concentrations in 1994/1998 were found in Upper Gold Run and Gold Run Pond. However, relatively high elevated concentrations of mercury and Aroclor[®] 1260 were found at individual stations in Lower Gold Run. Both of these chemicals pose a potential risk of bioaccumulation, as well as sediment toxicity. Metals considered to be sediment COPECs are chromium, copper, lead, mercury, and zinc. Although PAH compounds were elevated at multiple stations in all

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three areas of the Gold Run system, only a few individual compounds were found at relatively high concentrations at a small number of stations. Mean concentrations of individual PAHs ranged from 0.15 mg/kg for dibenzo[a,h]anthracene in Lower Gold Run to 7.1 mg/kg for fluoranthene in Gold Run Pond. This range of concentrations falls within the range of typical urban background levels of PAHs (e.g., 0.145 to 147 mg/kg for pyrene and 0.200 to 166 mg/kg for fluoranthene; ATSDR 1995), and levels such as these would be expected in a surface water system such as Gold Run, which receives suburban storm water runoff. Therefore, PAHs were not considered further for the Gold Run system and the only organic compound considered to be a COPEC is Aroclor® 1260. In addition, copper, lead, nickel, and zinc were elevated in the Southern Swale Areas 6 and 7.

1999 Data

Gold Run Pond

A number of metals exceeded their sediment screening values in Gold Run Pond during 1999 (Table 7). The greatest exceedances based on mean concentrations were found for chromium and copper. However, relatively high mean concentrations were also found for lead, mercury, and zinc. Based on single stations, nickel exhibited a relatively high exceedance at Station EA-5-SD.

Lower Gold Run

A number of metals exceeded their sediment screening values at the single station sampled in Lower Gold Run during 1999 (Table 7). However, none of the exceedances was considered relatively high. A key finding for Lower Gold Run is that the chromium and mercury concentrations of 38.1 and 0.87 mg/kg, respectively, found in 1999, were considerably lower than the values found in 1998 (i.e., 120 and 8.3 mg/kg, respectively) at the same general location. According to EA (2000), the station sampled in 1999 was located as close as possible to Station S11-2, which was sampled in 1998. These reductions in metals concentrations from 1998 to 1999 are likely a result of the storm sewer cleanup activities undertaken by the Navy in 1998 and 1999.

1999 Summary

The 1999 results presented above support the conclusions based on the 1994/1998 results that most elevated sediment chemical concentrations were found in Gold Run Pond, and that chromium, copper, lead, mercury, and zinc should be considered COPECs. Although the 1999 results suggest that mercury concentrations have declined substantially in Lower Gold Run relative to 1994/1998, the maximum value for mercury observed for Gold Run Pond in 1999 (3.7 mg/kg) was more than twice the value for mercury (1.6 mg/kg) found in the pond in 1994/1998. These results (in addition to the bioaccumulation potential of mercury) suggest that mercury should also be considered a COPEC.

2002/2003 Data

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Lower Gold Run

A number of metals exceeded their sediment screening values in Lower Gold Run during the 2002 sampling (Table 8). However, none of these exceedances was considered relatively high. The concentration of Aroclor[®] 1260 at Station WSE4 exceeded both the lower and upper screening values.

Southern Swale

A number of metals exceeded their sediment screening values in Areas 6 and 7 of the Southern Swale during 2002/2003 (Table 9). Relatively high exceedances based on mean concentrations were found for arsenic, copper, and zinc. Based on single stations, chromium was found at a relatively high concentration at one station (ISE5); nickel was found at relatively high concentrations at ISE2, ISE4, and ISE5.

Similarly, several metals exceeded their sediment screening values in Area 8 of the Southern Swale during 2002/2003 (Table 10). Relatively high exceedances based on mean concentrations were found for copper, nickel, and zinc. Based on single stations, chromium was found at a relatively high concentration at one station (WSE6).

2002/2003 Summary

The 2002/2003 results presented above support the earlier findings that chemical contamination of Lower Gold Run is relatively minimal. However, the more recent findings indicate that sediment contamination in the Southern Swale is relatively high and that arsenic, chromium, copper, nickel, and zinc should be considered COPECs.

2004/2006 Data

Upper Gold Run/Gold Run Pond

In 2006, the sediment of Upper Gold Run and Gold Run Pond was sampled and analyzed for volatile organic compounds (VOCs; Table 11). Almost all chemicals were undetected in surface sediment except isopropylbenzene in Gold Run Pond and trichloroethene in Upper Gold Run. No chemicals exceeded their sediment screening values.

Lower Gold Run

In 2006, the sediment of Lower Gold Run was sampled and analyzed for VOCs. All chemicals were undetected.

The underlying sediments (1 to 1.5 ft) of Lower Gold Run were sampled in 2004. Estimated (*J*-qualified) concentrations of several metals exceeded their screening values at Station CE-3 (Table 12). Detected concentrations of copper and mercury also exceeded their screening

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values. Copper at this station exceeded both the lower and upper screening values. In addition numerous PAH compounds exceeded both the lower and upper screening values at Station CE-3. However, as with the surface sediments of Gold Run, PAH concentrations at depth were within the range of concentrations that are typical of urban background levels (ATSDR 1995), and these levels would be expected in a surface water system such as Gold Run, which receives suburban runoff and storm water. Therefore, PAHs were not retained as COPECs.

Southern Swale

Tables 13 and 14 summarize the results of the screening evaluation for sediments in the Southern Swale Areas 6, 7, and 8. In 2006, sediment in the Southern Swale Areas 6, 7, and 8 were sampled and analyzed for VOCs. Trichloroethene was the only compound detected in the samples from Areas 6 and 7, and concentrations were below the NJDEP (1998b) screening value (Table 13). Toluene and trichloroethene were detected in sediment from the Swale Area 8, and concentrations were below screening values (Table 14).

2004/2006 Summary

Copper and mercury (because of its bioaccumulative potential) were identified as COPECs in the underlying sediment of Lower Gold Run based on sampling conducted in 2004. These deeper sediments (1 to 1.5 ft) were evaluated to assess the potential for risk from exposure under the scenario of scouring that might occur as a result of high flows.

Sediment samples from Upper Gold Run, Gold Run Pond, Lower Gold Run, and the Southern Swale areas 6, 7, and 8 were collected in 2006 and were analyzed for VOCs. Isopropylbenzene, toluene, and trichloroethene were the only VOCs that were detected, and all concentrations were below screening values.

Overall Sediment Summary

Based on the results of the screening evaluations conducted for sediments at the Site, it can be concluded that the kinds and magnitude of sediment contamination varied throughout the Site. Although sediment contamination in Lower Gold Run should be considered relatively low in general, the concentrations of some chemicals in other parts of the Site (i.e., Upper Gold Run, Gold Run Pond, and the Southern Swale) are relatively high. Based on the screening evaluations, the following chemicals should be considered COPECs for sediments at one or more locations of the Site: arsenic, chromium, copper, lead, mercury, nickel, zinc, and Aroclor[®] 1260.

Soil

Surface soil was sampled from Areas 6, 7, and 8 of the Southern Swale and Areas 10 and 11 west and east of Gold Run. Refer to Figure 10 for a map of these areas.

1994/1998 Data

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Areas 6 and 7

A number of metals exceeded their soil screening values in Areas 6 and 7 for surface soil samples collected in 1994/1998 from the Southern Swale (Table 15). The greatest exceedances were found for chromium, copper, nickel, and zinc. There were very few semivolatile organic compounds (SVOCs), PAHs, and VOCs with soil screening values. Chemicals of these classes did not exceed the available screening values.

Area 8

A number of metals exceeded their soil screening values in Area 8 for surface soil samples collected in 1994/1998 from the Southern Swale (Table 16). The greatest exceedances were found for chromium, copper, mercury, and zinc. There were very few SVOCs, PAHs, and VOCs with soil screening values. Chemicals of these classes did not exceed the available screening values. Aroclor[®] 1260 detected in soil at Area 8 did not exceed the soil screening value for total PCBs.

Area 10

A number of metals exceeded their soil screening values in Area 10 for surface soil samples collected in 1994/1998 near Gold Run (Table 17). The greatest exceedances were found for chromium, copper, mercury, nickel, and zinc. There were very few SVOCs, PAHs, and VOCs with soil screening values. Chemicals of these classes did not exceed the available screening values.

Area 11

A number of metals exceeded their soil screening values for surface soil samples collected in 1994/1998 in Area 11, in the northeast corner of the Site (Table 18). The greatest exceedances were found for arsenic, chromium, copper, and zinc. There were very few PAHs and VOCs with soil screening values. Chemicals of these classes did not exceed the available screening values.

2000 Data**Area 11**

A number of metals exceeded their soil screening values in Area 11 in 2000 (Table 19). The greatest exceedances were found for chromium, copper, mercury, and zinc. Mercury was found at relatively high concentrations at three stations (BF-S1, S2, and S3). There were very few PAHs with soil screening values. Chemicals of this class did not exceed the available screening values. Aroclors[®] 1260 and 1262 were detected at relatively high concentrations at Stations BF-S1, S5, S6, and S14. No soil screening values were available for the individual

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Aroclors[®] 1260 and 1262; however, the detected concentrations did not exceed the soil screening value for total PCBs.

1994/1998 and 2000 Summary

Surface soil from Areas 6, 7, 8, 10, and 11 was sampled in 1994/1998. Area 11 was also sampled again in 2000. Metals, particularly arsenic, chromium, copper, mercury, nickel, and zinc, which had the highest exceedances, were identified as soil COPECs. PCBs were also retained as COPECs because of their bioaccumulative potential.

2002/2003 Data

Areas 6 and 7

A number of metals exceeded their soil screening values in Areas 6 and 7 of the Southern Swale in 2002/2003 (Table 20). The greatest exceedances were found for arsenic, chromium, copper, mercury, nickel, and zinc. There were very few SVOCs and PAHs with soil screening values. Chemicals of these classes did not exceed the available screening values.

Area 8

A number of metals exceeded their soil screening values in Area 8 of the Southern Swale in 2002/2003 (Table 21). The greatest exceedances were found for chromium, copper, and zinc. Aroclor[®] 1260 was detected at a relatively high concentration at Station JSO4. No soil screening values were available for the individual Aroclors[®] 1260 and 1262; however, the detected concentrations did not exceed the soil screening value for total PCBs. There were very few PAHs with soil screening values. Chemicals of these classes did not exceed the available screening values.

Area 10

A number of metals exceeded their soil screening values in Area 10 in 2002/2003 (Table 22). The greatest exceedances were found for chromium, copper, nickel, and zinc. There were very few SVOCs and PAHs with soil screening values. Soil screening values were also not available for the individual Aroclors[®]. Chemicals of these classes did not exceed the available screening values.

Area 11

Six metals exceeded their soil screening values in Area 11 in 2002/2003 (Table 23). The greatest exceedances were for arsenic, chromium, copper, and zinc. There were very few PAHs with soil screening values. Chemicals of this class did not exceed the available screening values. No soil screening values were available for the individual Aroclor[®] 1260, which was detected at a relatively high concentration (15 mg/kg) at Station WSO3, but the detected concentrations for this chemical did not exceed the soil screening value for total PCBs.

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However, due to the bioaccumulative nature of PCBs, Aroclor[®] 1260 was retained as a soil COPEC.

2002/2003 Summary

Table 24 provides a summary of the most recent surface soil sampling for 2002/2003 for these five areas. Based on the information presented above, it appears that soil contamination is variable throughout the Site. The COPECs for soil are considered to be arsenic, chromium, copper, lead, mercury, nickel, zinc, and Aroclor[®] 1260.

Overall Soil Summary

Soil contamination is variable throughout the Site. However, based on the combined results for the overall Site, the following metals should be considered COPECs: arsenic, chromium, copper, lead, mercury, nickel, zinc. The individual Aroclor 1260[®] did not exceed the soil screening value for total PCBs, but was detected at relatively high maximum concentrations in Areas 8 (Station JSO4) and 11 (Station WSO3). Because of the propensity of PCBs to bioaccumulate and biomagnify, Aroclor 1260[®] was retained as a soil COPEC.

Results of Food-Web Modeling Conducted by the Navy

A key concern with respect to chemicals that tend to bioaccumulate in aquatic organisms is the potential risk presented by food-web transfer to higher-trophic-level aquatic organisms (e.g., reptiles and predatory fish) or to terrestrial wildlife (i.e., birds and mammals). To address this concern for potential inputs to the Gold Run System from the former NAWC facility, EA (2000), on behalf of the U.S. Navy, conducted a food-web evaluation based on the data they collected in 1999 on chemical concentrations in surface water, sediments, and biota. The concentrations of various chemicals in the tissue of fishes collected from Gold Run Pond and in the oligochaete *Lumbriculus variegatus* following a 28-day laboratory exposure to Pond sediments are presented in Tables 25 and 26.

Analyses of bioaccumulation and trophic transfer are not typical components of a BEE. This food-web assessment is included herein only because the NAWC data were available and pertinent to the Gold Run System.

EA (2000) conducted food-web modeling for eight metals: arsenic, chromium, copper, lead, mercury, selenium, silver, and zinc. Because this study was conducted by EA for the U.S. Navy, it focused on only these substances, which were identified at that time as chemicals of concern for the former NAWC facility. Potential exposure to these metals in Gold Run Pond was evaluated for the snapping turtle (*Chelydra serpentina*), belted kingfisher (*Ceryle alcyon*), and raccoon (*Procyon lotor*). EA (2000) assumed that metals were 100 percent bioavailable at the maximum detected concentration in each medium. Estimated exposure concentrations were compared by EA to no-observed-adverse-effect levels, and hazard quotients (HQs) were calculated by comparing the estimated exposure concentrations to toxicity reference values (Table 27). HQs less than 1.0 indicate low potential risks to ecological receptors.

Using a conservative assumption of an area use factor of 1.0 (i.e., the organisms are exposed to Gold Run Pond media 100 percent of the time), the only HQs that exceed 1.0 were those for the belted kingfisher exposure to chromium (HQ = 3.3) and zinc (HQ = 2.1) (Table 27) (EA 2000). These results indicate that chromium and zinc may pose a risk to belted kingfishers, assuming the unlikely scenario that these receptors forage 100 percent of the time at Gold Run Pond. When the models were run using an actual area use factor (0.28) for kingfisher based on the size of the home range of this species, none of the HQs exceeded 1.0. EA (2000) concluded that the results of the food-web evaluation indicated that metals in Gold Run Pond do not represent a risk to ecological resources.

Summary and Conclusions

Based on the information obtained from the literature, historical data, and the Site visits, the need for additional ecological investigations was determined. Because of the limited size of the habitat resources onsite, and the availability of larger tracts of more suitable habitat nearby, this evaluation concludes that population-level ecological effects from exposure to COPECs are unlikely and additional ecological investigations are not warranted.

Only portions of the Former Delphi Interior and Lighting Systems Site provide resources sufficient to support ecological receptors. These areas include the forested areas associated with Gold Run, vegetated areas along the Southern Swale, the Southern Swale itself, and Gold Run and Gold Run Pond. Contaminant migration pathways to these environmentally sensitive areas exist, from both Site-related and offsite sources. These environmentally sensitive areas constitute a small portion of the Site and are limited in their areal extent. The majority of the Site consists of developed (e.g., paved and concrete) and barren areas that were associated with the former Plant operations and do not provide habitat for ecological receptors.

From a fish community standpoint, the Gold Run System does not support a diverse community. A large dam at the School for the Deaf forms a barrier to upstream migration of fishes from the lower reaches of Gold Run and the Delaware River, and there are no permanent upstream water bodies that would support fish communities. An electroshocking survey conducted in Gold Run Pond by EA for the former NAWC facility supports this conclusion, because only three fish species were captured (golden shiner, brown bullhead, and creek chub), and one species (creek chub) was represented by a single individual.

The results of screening evaluations conducted for data on chemical concentrations in surface water, sediments, and soil collected at the Site between 1994 and 2006 identified a number of COPECs, primarily metals and Aroclor[®] 1260. The COPECs for each environmental medium are considered to be the following:

- **Surface Water:** Barium, copper, lead, and mercury
- **Sediments:** Arsenic, chromium, copper, lead, mercury, nickel, zinc, and Aroclor[®] 1260 in surface sediment; and copper and mercury in underlying sediment of Lower Gold Run
- **Soil:** Arsenic, chromium, copper, lead, mercury, nickel, zinc, and Aroclor[®] 1260.

Mercury and Aroclor[®] 1260 are considered COPECs, because they have a propensity to bioaccumulate and biomagnify in aquatic and terrestrial food webs. A food-web modeling study conducted by EA for the U.S. Navy NAWC facility for metals in surface water, sediment, and fish and oligochaete tissue from Gold Run Pond indicated that metals, including mercury, do not represent a risk to higher-trophic-level organisms such as snapping turtles, belted kingfishers, and raccoons using the Gold Run System (EA 2000). Although bioaccumulation of Aroclor[®] 1260 was not evaluated at the Site when the Navy performed this study, both mercury

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