Focused Corrective Measures Study Work Plan

Tecumseh Redevelopment Site
Lackawanna, New York

May 2009 0071-008-111

Prepared For:

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FOCUSED
CORRECTIVE MEASURES STUDY
FOR
ACID TAR PITS SWMU GROUP

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1.0 INTRODUCTION

1.1 Former Bethlehem Steel Site History and Current Property Ownership

ArcelorMittal Tecumseh Redevelopment Inc. (Tecumseh) owns approximately 1,070 acres of property located along the west side of NYS Route 5, Lackawanna, New York (the "Tecumseh Property" or " Tecumseh Site") comprising a significant portion of the former Bethlehem Steel Corporation – Lackawanna Facility (the "former BSC Property" or "former BSC Site"). Site regional and vicinity maps are provided in Figures 1 and 2, respectively.

The former BSC property was used for iron and steel production since the beginning of the 20th century. Steel-making operations were discontinued by the end of 1983, and, by the mid-1990s, most of the steel-making facilities on the west side of Hamburg Turnpike (NYS Route 5) had been demolished. In September 2001, BSC's coke oven operation was terminated leaving only a galvanized products mill operating by BSC at the Site.

In 2001 BSC filed for bankruptcy protection. Tecumseh acquired the Tecumseh Property pursuant to an Asset Purchase Agreement that was approved by the United States Bankruptcy Court for the Southern District of New York in April 2003 (Case No. 01-15288 Jointly Administered). Tecumseh, however, is not the owner of several portions of the former BSC property. The manufacturing operations formerly owned by BSC on the east side of NYS Route 5 are now owned, in part, by ArcelorMittal USA Inc. (Tecumseh's parent corporation) and, in part, by Republic Engineered Products, Inc. Approximately 232 acres of property on the west side of NYS Route 5 were sold by BSC prior to the April 2003 asset purchase agreement and which, upon information and belief, are currently owned by Gateway Trade Center, Inc. and Genesee & Wyoming, Inc. Figure 3 shows the former Bethlehem Steel Corporation-Lackawanna Facility and current ownership of subparcels.

1.2 RCRA Corrective Action Program Status

Bethlehem Steel Corporation and the United States Environmental Protection Agency (USEPA) entered into an Administrative Order on Consent in August 1990 (Docket No. II RCRA-90-3008(h)-0201). Under terms of the 1990 USEPA Order, BSC agreed to perform a RCRA Facility Investigation (RFI) to identify the nature and extent of any releases of hazardous constituents from 104 Solid Waste Management Units (SWMUs). The

potential impacts on water and sediment quality in six surface water bodies (watercourses) located on or adjacent to the former BSC property were also to be addressed in the RFI. As the RFI Report was incomplete when Tecumseh acquired (most of) the former BSC property in 2003, Tecumseh immediately initiated efforts to expeditiously complete the RFI. The Final RFI Report submitted to USEPA in January 2005 recommended 38 SWMUs and three watercourses (i.e. Smokes Creek, South Return Water Trench, and Blasdell Creek) for further evaluation in a Corrective Measures Study (CMS). In a letter dated May 17, 2006, USEPA identified five additional SWMUs and two additional watercourses for further evaluation in the CMS. All of the other SWMUs identified by USEPA in the 1990 Order were determined by USEPA to require no further assessment as they do not pose a significant potential risk to human health or the environment. Later, in September 2006, USEPA deemed the provisions of the 1990 Order to be satisfied and Tecumseh's obligations under the 1990 Order terminated.

1.3 Tecumseh Site Description

The Tecumseh Site can generally be subdivided into the following parcels based upon former manufacturing operations, historic, current and planned uses as illustrated in Figure 4:

- Slag Fill Area (SFA) (approx. 379 acres, excluding Steel Winds I)
- Steel Winds I (approx. 29 acres)
- Coal, Coke, and Ore Handling and Storage Area (approx. 137 acres)
- Former Petroleum Bulk Storage (Tank Farm) Area (approx. 68 acres)
- Former Coke Plant and By-Products Facilities (approx. 45 acres)
- Business Park Phases I, IA, II, and III (approx. 405 acres combined)
- Watercourses

1.4 Slag Fill Area and Acid Tar Pits SWMU Group

The Site's first steel-making facilities were built along the lakeshore. During the time of integrated steel-making operations, the Site was extended into Lake Erie by placing blast furnace iron-making slag as well as open hearth furnace and basic oxygen furnace steel-making slag along the shoreline. As a result, approximately 408 acres of man-made land

were reclaimed from Lake Erie; this portion of the site is referred to as the Slag Fill Area (SFA). This land filling activity was conducted in an area of the lake that included two Federal Dumping Grounds used by the U.S. Army Corps of Engineers (USACE) and possibly others for the deposition of dredge spoils from the Buffalo Harbor and Buffalo River. The location of the SFA is shown on Figure 4.

BSC records and aerial photographs from 1938 to the present indicate that the SFA was also historically used for the management of solid wastes and disposal of miscellaneous fill materials, including sludge from wastewater treatment plants; sludge, dust, and liquids from iron-making, steel-making, steel-forming, steel-finishing, and coke-making operations; dredge spoils from Smokes Creek and the Buffalo Harbor; and construction and demolition debris from BSC's former operations and structures at the Site. As shown on Figure 4, five SFA zones have been designated.

SFA Zone 1 contains predominantly iron-making or blast furnace slag that has been substantially reclaimed for beneficial use as a building aggregate. There are no SWMUs requiring further assessment in Zone 1. Iron slag reclamation in Zone 1 was discontinued in 2006 as removal was substantially completed to elevations generally at or below 585 feet above mean sea level (less than 10 feet above Lake Erie mean water level).

SFA Zone 2, the elevated fill area located adjacent to the south bank of Smokes Creek, contains 12 SWMUs that require further assessment in the CMS. Several of the SFA Zone 2 SWMUs contain mill scale that may be reclaimed as a raw material for steel making. The Acid Tar Pit SWMUs (S-11 and S-22) and the Agitator Sludge SWMU (S-24) are located adjacent to the Creek (see Figures 4 and 5). These three SWMUs (S-11, S-22, and S-24) are collectively referred to as the Acid Tar Pit SWMU Group or ATP SWMU Group based upon their proximity to each other as well as their similar fill constituents. The ATP SWMU Group has been identified by Tecumseh and NYSDEC as a "high-priority" SWMU group due to the volume and nature of the fill materials as well as their proximity and environmental impact on Smokes Creek as further described in Section 3.0.

SFA Zones 3, 4, and 5 located north of Smokes Creek contain predominantly steel-making slag that is being reclaimed for beneficial reuse (from areas outside the boundaries of the SWMUs requiring further action).

1.5 Smokes Creek

Smokes Creek is a natural water body that traverses the Site from east to west prior to discharging into Lake Erie (see Figure 5). Smokes Creek originates as two branches: the North Branch, which drains a portion of West Seneca, Lackawanna, and Orchard Park, New York, and the South Branch, which drains areas in Lackawanna and Orchard Park. The North and South Branches of the Creek join in Lackawanna upstream of Route 5, entering the east side of the Site near Monroe Avenue and flowing westward across the Site to Lake Erie. Smokes Creek is classified by the New York State Department of Environmental Conservation (NYSDEC) as a Class C stream, which is defined as suitable for fish propagation and survival with water quality expected to be suitable for primary and secondary contact recreation, although other factors, such as property ownership and access, may limit the use for these purposes.

On the Tecumseh Site, the Creek has been divided into two sections, the Upper Reach, measuring approximately 3,900 feet, from Route 5 to Site Highway 9 (bridge) and the Lower Reach, measuring approximately 2,600 feet from the Site Highway 9 bridge to Lake Erie (see Figure 5).

Sediment that has accumulated in Smokes Creek, particularly the Lower Reach, has recently been determined by the USACE to be reducing the hydraulic flood flow and contributing to the expansion of the 100-year flood plain in the City of Lackawanna First Ward. As part of the U.S. Flood Control Act of 1960 (Public Law No. 86-645), the USACE undertook channel improvements in Smokes Creek from its outlet to Lake Erie across the entire former Bethlehem Steel (now Tecumseh) Property and further upstream to beyond the confluence of the North and South Branches in the City of Lackawanna. The lower 2,600 linear feet of the Smokes Creek flood improvements were constructed by Bethlehem Steel Corporation in accordance with its Land Patent Agreements with the Federal and State governments, as this portion of Smoke's Creek and the adjacent lands were reclaimed from Lake Erie by placement of slag fill. BSC was also obligated by the Land Patent Agreements to operate and maintain the Smokes Creek flood channel along the lower 2,600 linear feet in accordance with an Operation and Maintenance Manual issued by the USACE in May 1972. However, little if any maintenance of the Creek was performed by BSC since the steel plant closed over 20 years ago. Tecumseh, as successor and assign to BSC on this property, has effectively assumed the maintenance obligations for this portion of the Smokes Creek flood

channel. The NYSDEC has responsibility to operate and maintain the balance of the Smokes Creek flood channel including approximately 3,900 linear feet on the former Bethlehem Steel property upstream of the Land Patent lands.

Tecumseh has recently completed an interim corrective measure (ICM) to dredge the lower reach of Smokes Creek to design elevations to mitigate the expansion of the 100-year flood plain in the City of Lackawanna First Ward and to fulfill its obligations under the Land Patent Agreement at a cost of approximately $1.5 million. Much of the sediment dredged contains contaminants that are believed to have migrated from the ATP SWMU Group. In order to promptly mitigate the continued migration of contaminants from these high-priority SWMUs to the Creek via groundwater discharge and surface water flow and thereby avoid recontamination of the Creek sediment, this Focused CMS is proposed to be undertaken by Tecumseh separately from the other SWMUs to be addressed in the broader and more comprehensive CMS for the remainder of the CMS Site.

The NYSDEC is also planning to dredge the upper reach of Smokes Creek.

1.6 Purpose and Scope of the Focused Corrective Measures Study

The impetus to remediate all three SWMUs collectively as soon as possible as a Focused CMS stems from: the recent dredging of Smokes Creek as an ICM and the need to protect the Creek from recontamination; the similar source(s) and nature of the wastes previously disposed in these SWMUs; and from the fact that these SWMUs are considered a high-priority for remediation due to the significant quantities of contaminants that are migrating via groundwater to Smokes Creek. If the ATP SWMU Group is not addressed promptly, their remediation will be delayed several years until the CMS is complete and comprehensive corrective measures are designed and constructed.

The purpose of this Focused Corrective Measures Study (CMS) is to:

- Identify data gaps and gather additional information that may be necessary to determine if corrective measures are necessary, and/or to properly evaluate remedial alternatives for the Acid Tar Pit SWMU Group only on an expedited time schedule.
- Define site-specific corrective measure objectives for the ATP SWMU Group and associated environmental media.

- Evaluate appropriate feasible remedial alternatives on the basis of performance criteria consistent with statutory requirements and applicable regulations.
- Recommend a remedy for the ATP SWMU Group that meets all corrective measure objectives.

2.0 CORRECTIVE MEASURE OBJECTIVES

2.1 General

The fundamental objectives of this Focused Corrective Measures Study are to identify and evaluate feasible alternative remedies and to recommend a combination of corrective or remedial measures for the Acid Tar Pit SWMU Group (SWMUs S-11, S-22 & S-24) that collectively will be protective of public health and the environment. Other threshold criteria for remedy selection are that it must:

- Be protective of human health and the environment;
- Attain applicable media cleanup standards;
- Control the source(s) of releases to reduce or eliminate further releases of hazardous constituents to the environment;
- Comply with applicable waste management standards and regulations, and;
- Be consistent with current and reasonably anticipated future use of that portion of the Site.

2.2 Corrective Action Management Units

The concept of Corrective Action Management Units (CAMUs) is embodied in the RCRA Hazardous and Solid Waste Amendments of 1984 (HSWA Amendments) that allows for the consolidation and management of remediation wastes from several SWMUs in one or more locations to reduce its volume, toxicity and/or mobility. On August 22, 2000 the USEPA published a rule (65 FR 51080) referred to as the CAMU Amendments that effectively "grandfathered" any "substantially complete" CAMU applications received by USEPA or an authorized state, such as New York, within 90 days of the rulemaking (i.e., on or before November 20, 2000). Consequently, in New York, a CAMU implemented pursuant to such a grandfathered application would be subject to the existing 1993 CAMU regulations set forth in 6 NYCRR Part 373-2.19. On November 16, 2000 Bethlehem Steel Corporation, as the waste generators and owner of the subject property at that time, submitted an application for two CAMUs to be located in the Slag Fill Area-Zone 2: a Solid Waste CAMU into which solid waste would be consolidated and contained; and a Hazardous Waste CAMU into which hazardous waste would be consolidated and contained. In a letter

dated November 17, 2000 the NYSDEC deemed the CAMU application substantially complete and advised that the proposed CAMUs are subject to the 1993 CAMU regulations. The NYSDEC's letter went on to clarify that development of detailed designs for the CAMUs would be addressed in the CMS. Accordingly, Tecumseh intends to develop detailed designs consistent with the 1993 regulations for the grandfathered CAMUs as part of the CMS. One of the alternative corrective measures evaluated in this Focused CMS is based on the potential use of a Hazardous Waste CAMU for on-site disposal of the impacted soil/fill to be excavated from the ATP SWMUs.

2.3 Groundwater Objectives

Groundwater impacts within, under and adjacent to the ATP SWMU Group are identified in Section 3 of this Work Plan. The assessment of alternative corrective measures to attain groundwater objectives are presented in Section 4 of this Focused CMS. Broader groundwater objectives for the entire CMS Site will be addressed in the subsequent CMS and associated Long-Term Groundwater Monitoring (LTGWM) Plan. The objective of the LTGWM Plan is to monitor downgradient groundwater quality discharged from the entire CMS Area to adjacent surface water bodies Lake Erie, Smokes Creek, and the Lackawanna Ship Canal (Gateway Metroport). The LTGWM Plan is incorporated as Appendix E of the CMS Work Plan.

Groundwater quality objectives specific to the ATP SWMU Group are to contain, collect and/or treat the heavily contaminated groundwater and/or source materials in, under or adjacent to the SWMUs such that downgradient groundwater quality will not degrade and will eventually improve so as not to continue to significantly impact water and sediment quality in Smokes Creek.

3.0 SUMMARY OF RFI FINDINGS AND SUBSEQUENT CHARACTERIZATION

Following are summaries of the ATP SWMU Group and Smokes Creek data and associated RFI findings. In an effort to close data gaps identified in the RFI data, a post-RFI characterization of the ATP SWMU Group was conducted in order to delineate the vertical and lateral extent of each SWMU in the Group. The results of those investigations are also discussed in this section.

Figures 6 and 7 present the approximate location of pre-RFI, RFI and post-RFI samples collected from various media (i.e., groundwater from monitoring wells, subsurface soil from borings, surface soil samples, sediment and surface water samples from watercourses etc.) in and adjacent to SWMUs S-11 and S-22.

3.1 Acid Tar Pit SWMUs

SWMUs S-11 and S-22 are located south of Smokes Creek in the eastern portion of SFA Zone 2 (see Figures 4 and 6). SWMU S-24 is located on the north bank of Smokes Creek approximately 2,600 feet upstream of the Lake Erie confluence (see Figures 4 and 8), and immediately west of the Highway #9 bridge. Although SWMU S-24 is not within SFA Zone 2, the waste material identified within this unit is consistent with materials placed within SWMUs S-11 and S-12; therefore, this unit has been included in the Acid Tar Pit SWMU Group. Due to different waste disposal histories, each SWMU is discussed separately in the following paragraphs.

3.1.1 SWMU S-11

The RFI describes SWMU S-11, is an elongated surface impoundment approximately 1.4 acres in area and filled with approximately 50,000 cubic yards of waste material by-products from steel and coke making operations deposited from the 1950s into the early 1970s. The waste material consists primarily of iron precipitator dust and waste lime, with lesser amounts of coke oven waste extending to a depth of approximately 20 to 30 feet below ground surface (fbgs). The surface is relatively level and only half covered with vegetation consisting of gravel-sized slag with smaller quantities of stone, bricks, and other

steel manufacturing debris. Several small mounds of slag exist in the immediate vicinity of the unit.

According to the RFA (USEPA 1988), materials placed within this unit included: discarded drums from plant operations containing various wastes, including condensate from burning of foul gas from the coke oven gas sulfur recovery process, oil from several water quality control stations, hydraulic oil, paint residues, paint house filters, solvent cleaning solutions, and various degreasing compounds, including 1,1,1-trichloroethane; open hearth precipitator dust from electrostatic precipitators installed to clean exhaust gases from open-hearth operations; and lime dust collected in a bag house associated with basic oxygen furnace (BOF) steel-making operations. SWMU S-11 is not an engineered containment structure and was constructed without a barrier baseliner and/or final cover system. A dense glacial till unit underlies this SWMU approximately 38 to 52 feet below ground surface which acts as a vertical confining unit to inhibit the downward flow of impacted groundwater.

The RFI data concluded the following regarding SWMU S-11:

- Numerous hazardous constituents (VOCs, SVOCs, and several metals) are present in slag/soil/fill and vary in concentration with waste type.
- Materials of high pH (>11 s.u.) are present, although pH levels vary with waste type.
- Due to the nature of the materials within the ATPs and surface topography a groundwater mound exists in the SWMU.
- RFI soil/slag/fill samples collected did not exhibit hazardous characteristics via TCLP; however, other soil/slag/fill sampling of SWMU S-11 exhibited hazardous characteristics for benzene.
- VOCs, SVOCs, and several metals were present in groundwater samples collected from both the upgradient and downgradient monitoring wells.

3.1.2 SWMU S-22

The RFI describes SWMU S-22 as an elongated group of three surface impoundments totaling approximately 1.4 acres in area and filled with approximately 50,000 cubic yards of waste by-products from steel and coke manufacturing deposited from the 1950s into the early 1970s. The unit is surrounded by an earthen and slag berm approximately 3 to 8 feet high while the surface of the SWMU is approximately 3 to 5 feet

below the berm in most areas. The RFI reports the waste profile extends to an approximate depth of 20 to 40 feet below ground surface with groundwater encountered within the fill at 10 to 20 feet below ground surface.

During the RFI, investigatory borings and various analyses identified five major waste types: spent pickle liquor, coal tar, coke oven gas/condensate, waste lime, and iron oxide precipitator dust. These wastes were observed to be co-mingled and partly stratified within the ATPs. All waste types except the lime and iron precipitator dust contained elevated concentrations of benzene ranging from 92 to 29,000 mg/kg. Each waste is described briefly below:

Waste Type	Physical Characteristics	Chemical Characteristics
Spent Pickle Liquor	Pink and olive green silt and fine sand-sized particles, occasional mottling, and exhibiting a pungent acid odor and a strong positive response on the photoionization detector (PID)	Very low pH (2.0 standard units (s.u.)
Coal Tar	Black, sticky, cohesive material often with a naphthalene-like odor (e.g., moth balls) and a strong positive PID response	Elevated concentrations of SVOCs: naphthalene (42,000 mg/kg), phenanthrene (18,000 mg/kg), phenol (1,600 mg/kg), pyrene (9,200 mg/kg); METALs: arsenic (21 mg/kg), barium (65 mg/kg), lead (90 mg/kg), nickel (29 mg/kg); OTHER: sulfide (1,020 mg/kg), British Thermal Units (BTU) content (11,500 BTU/lb)
Coke Oven Gas Condensate	Dark grey to black non-sticky material consisting of silt and fine sand-sized particles exhibiting hydrocarbon odors and a strong positive PID response	Elevated concentrations of SVOCs: fluorene (ND to 340 mg/kg), naphthalene (3.7 to 850 mg/kg), phenanthrene (<1 to 180 mg/kg); METALs: lead (12 to 108 mg/kg); OTHER: BTU content (<1,000 to 6,720 BTU/lb), pH (0.38 to 1.79 s.u.)
Waste Lime	White to pinkish-grey silt-sized material exhibiting a strong positive PID response	High pH (11 s.u.)
Iron Precipitator Dust	Brown to reddish-brown silt to fine sand-sized material with a lower positive PID response	High pH (11 s.u.)

SWMU S-22 is not an engineered containment structure and was constructed without a barrier baseliner and/or final cover system. A dense glacial till unit underlies this SWMU approximately 38 to 52 feet below ground surface which acts as a vertical confining unit to inhibit the downward flow of impacted groundwater.

The RFI concluded the following regarding SWMU S-22:

- Several waste fill material samples exhibited hazardous characteristics for benzene and pyridine.
- Numerous hazardous constituents (VOCs, SVOCs, and several metals) are present in waste fill and vary in concentration with waste type.
- Some waste fill samples exhibited a pH less than 2 which are considered a characteristic hazardous waste based upon corrosivity.
- Due to the physical nature of the materials within the ATPs and topography, a groundwater mound exists in the SWMU.
- Hazardous constituents found in both the fill and sand units' groundwater has migrated horizontally from SWMU S-22 toward Smokes Creek.

3.1.3 SWMU S-24

SWMU S-24 is an oval-shaped disposal pit measuring approximately 1 acre in area, filled with acid tar (agitator) sludge generated from the Benzol Plant. Agitator sludge found within this unit was generated during benzene processing when the product (benzene) was washed with sulfuric acid to separate impurities. The resulting waste stream was neutralized with a caustic solution, which produced the agitator sludge.

The tar-like waste material extends to a depth of approximately 10 feet below ground surface (fbgs) with deeper zones extending to a depth of 20 feet; possibly the result of vertical migration of the tar material. An elongated mound of slag-fill and debris exists in the eastern portion of the SWMU. The surface slopes gently from west to east with areas of no and low vegetative cover. Although this unit is covered with slag, small localized areas of a tar-like substance have occasionally been observed at the surface during the summer months. SWMU S-24 is not an engineered containment structure and was constructed without a barrier baseliner and/or final cover system. Groundwater within the shallow fill unit is approximately 10 to 14 fbgs. The RFI concluded the following regarding SWMU S-24:

- Agitator sludge waste was disposed of in this SWMU from at least 1938 to 1950. Waste fill/slag samples collected after 1993 from the SWMU indicate the presence of 8 VOCs, 23 SVOCs, metals, and cyanide.
- Much of the waste fill material within SWMU S-24 is characteristically hazardous for benzene, pyridine, and nitrobenzene based upon Toxic Compound Leaching Protocol (TCLP) test results.
- In the 1994 samples, naphthalene was the only compound detected in the Synthesis Precipitation Leaching Protocol (SPLP) extract indicating that is the only waste fill constituent likely to migrate from the SWMU in groundwater.
- The pH of the waste material was determined to be as low as 0.63 standard units (SU) indicating that it is a characteristic hazardous waste exhibiting corrosivity.
- Four VOCs, 11 SVOCs, 15 metals, and cyanide were detected in the 2001 surface soil/fill samples.
- A November and December 1996 electrical imaging survey indicated the waste fill extends 5 to 10 fbgs, and in some areas as deep as 20 fbgs.

3.2 Post-RFI Characterization of the ATP SWMU Group

The RFI data collected from the ATP SWMUs was deemed insufficient to define the lateral and vertical extent of the SWMUs for purpose of remedy design and preparation of remedial cost estimates. A planned perimeter test pitting and boring program was implemented by Turnkey in April-May 2008 at the Agitator Sludge and ATPs SWMUs, respectively, to more adequately delineate the lateral and vertical extent of fill as well as to confirm the presence and depth to the confining soil unit beneath these SWMUs as identified during the RFI. The results of post-RFI investigations are discussed below.

Post-RFI ATP SWMU Investigation

The ATP SWMU investigation boring program included the advancement of 14 perimeter borings around the combined perimeter of SWMUS S-11 and S-22. The completed boring locations, shown on Figure 7, were selected based upon a review of available data collected from the ATP SWMUs including, but not limited to, standard boring logs, resonant sonic boring logs, and an electrical imaging (EI) survey. Some boring locations required field modification from their planned locations to avoid surficial waste material exposed during preliminary clearing of the area and due to refusal. Borings where

refusal was not encountered were advanced a minimum of 4 feet into the lower confining till unit. In general, the depth to the lower confining unit ranged from approximately 38 to 52 feet below ground surface. Table 1 summarizes the boring data.

3.3 Agitator Sludge SWMU Investigation

The Agitator Sludge SWMU test pit investigation included the excavation of 13 test pits (see Figure 8) to delineate the lateral and vertical extent of waste material within SWMU S-24 as well as to confirm the depth to the confining soil unit identified during the RFI. In general, test pits were excavated in a radial pattern starting at a known location of waste fill material. Upon visual confirmation of waste fill material (i.e., black with elevated PID readings), each test pit was extended outward until the waste fill was no longer observed. Periodically during lateral advancement of each test pit, the confining layer described in the RFI was confirmed and an average waste fill material vertical thickness was determined. With these more accurate measurements in hand, it was calculated that approximately 23,000 CY of waste fill material exists within the SWMU S-24.

Concurrent with test pitting activities, nearby monitoring wells MWN-24A, MWN-24B, and MWN-44 were inspected for integrity, re-developed, sampled, and analyzed for TCL VOCs and TCL SVOCs (base-neutrals only). Monitoring wells MWN-24A and MWN-44A are screened within the fill material and well MWN-24B is screened within the underlying low-permeability till unit beneath the Agitator Sludge SWMU. Groundwater results for those monitoring wells are presented in Table 2. The analytical results reported from the April 2008 monitoring event are generally similar to the November 1999 RFI groundwater results as shown in the table. The till unit well, MWN-24B, continues to show no impact as a result of the overlying fill and waste within the SWMU. The till unit well, MWN-24B, continues to show no impact as a result of the overlying fill and waste within the SWMU. Groundwater quality at well MWN-44A appears to have greatly improved since November 1999 based upon VOC and SVOC concentrations reported for that location. Polycyclic aromatic hydrocarbons (PAHs), however, continue to persist at concentrations above the GWQS/GVs at monitoring well MWN-44A.

3.4 Smokes Creek

In conjunction with the soil/fill and groundwater investigations/assessments performed prior to and during the RFI at the Tecumseh Site, surface water bodies on or proximate to the Tecumseh Site including Smokes Creek were also investigated for site-specific Constituents of Potential Interest (COPI) during the RFI through the analysis of surface water and sediment samples. Only the lower reach of Smokes Creek adjacent to the ATP SWMU Group is addressed in this Focused CMS due to its proximity with the ATP SWMU group and associated groundwater impacts.

The RFI concluded the following relative to the lower reach of Smokes Creek:

- The TCLP extract concentrations indicate that the sediment in Smokes Creek is not characteristically hazardous.
- Analytical results of surface water and sediment indicate that the primary constituents of concern in the sediment are SVOC, PAHs, and several metals (e.g., As, Cr, Pb)

3.5 Post RFI Smokes Creek Sediment Characterization

Sediment characterization sampling was performed by TurnKey in June 2007 on the lower 2,600 feet of Smokes Creek (Lower Reach) and in December 2007 on the remaining 3,900 feet of the Creek (Upper Reach). The supplemental sampling program conducted was determined by NYSDEC and the United States Army Corps of Engineers (USACOE) to have adequately characterized the sediments for purposes of dredging and dredge spoils disposal.

3.6 CMS Site Groundwater in the Vicinity of the ATP SWMU Group

The Tecumseh property is overlain with man-made deposits particularly near the Lake and thinning toward the east. The natural surficial geology of the Site underlying this fill unit is composed primarily of lake sediments consisting of blanket sands and beach ridges that are predominantly underlain by lacustrine silts and clays and/or glacial till with some interbedded pockets of peat near the eastern property boundary. The granular fill and sand deposits generally act as a shallow hydraulically-connected unconfined groundwater unit, whereas the deeper lacustrine clays and glacial tills act as an aquitard hydraulically separating the shallow unconfined unit from the deeper confined bedrock groundwater unit. The low-

permeability (average K_V=6.0 x 10^{-8} cm/sec and K_H = 2.18 x 10^{-5} cm/sec) silty clay and till confining unit ranges in thickness from 2 to 50 feet and is present beneath most of the Site. This relatively ubiquitous confining unit results in a significant degree of hydraulic separation between the unconfined water table and the bedrock groundwater unit (RFI, October 2002). Only two small areas of the CMS Area were discovered during the RFI to be absent of this confining unit; the area near wells MWN-17A and 17B and the area near the mouth of Smokes Creek over 2,000 feet away from the ATP SWMU Group.

The RFI identified six distinct hydrogeologic units at the CMS Area, listed from grade, as: fill, peat, sand, silt and clay, glacial till, and shale or limestone bedrock. Because only a few wells were installed to monitor the peat and confining units (i.e., silt and clay, and glacial till) across the site and for ease of discussion pertaining to groundwater quality, these units have been grouped together into a miscellaneous group. A total of 164 monitoring wells were installed within these groundwater units across the Site including 114 fill unit wells, 33 sand unit wells, 8 miscellaneous unit wells (2 peat, 3 clayey silt, 1 clay, 1 till, and 1 clayey silt and till), and 9 bedrock wells. Seven wells have since been abandoned or destroyed (2 fill, 4 sand, and 1 miscellaneous/clay).

During the RFI, 140 of the 164 on-site wells were sampled as part of a comprehensive sampling program conducted in November 1999 and December 2000, 127 of which are or were located within the CMS Area of the Site (two wells were abandoned in October 2000). Of the 127 CMS Area wells, 86 are screened within the fill unit, 28 within the sand unit, 7 within the miscellaneous unit, and 6 within the bedrock. These monitoring wells were installed to monitor the upgradient, cross gradient, and downgradient groundwater quality proximate to each investigated SWMU.

Based on isopotential maps created during the RFI, Site groundwater flow patterns within the saturated fill unit (i.e., shallow groundwater), including several groundwater divides and flow boundaries, separate the Tecumseh Site into 6 distinct discharge areas, four of which are within the CMS Area of the Site, and all of which are identified in the table below and shown on Figure 9.

Discharge Area	Receiving Surface Water Body	Approx. Area (million sq. ft.)	Within CMS Area
1	Lake Erie	11.17	No
1A	Blasdell Creek	1.31	No

2A	Lake Erie	2.15	Yes
2B	Smokes Creek	1.34	Yes
3	Smokes Creek	11.41	No
3A	Smokes Creek	1.99	Yes
4A	Lake Erie	16.75	Yes
4B	Lake Erie (via Outer Harbor)	2.23	Yes
5	Ship Canal	1.05	Yes
6	Ship Canal	5.49	No
6A	Union Canal	2.58	No

The CMS Area of the Site only includes Discharge Areas 2A, 2B, 3A, 4A, 4B, and 5. Groundwater within Discharge Areas 2A, 4A, and 4B flows west discharging to Lake Erie either directly (2A and 4A) or indirectly via the Outer Harbor (4B); groundwater within Discharge Areas 2B and 3A flows north and south, respectively, discharging to Smokes Creek; and groundwater within Discharge Area 5 flows east discharging to the Ship Canal.

Recharge at the Site is from rainfall and snowmelt, most of which evaporates or infiltrates to the subsurface. Any Site runoff is eventually intercepted by one of the surrounding surface water bodies (i.e., Smokes Creek, the Ship Canal, the Buffalo Outer Harbor, or Lake Erie). Some minor artificial recharge to Discharge Area 5 is suspected through leaking underground water lines in the Coke Oven Area, which has been confirmed by groundwater flow observations during the Benzol Plant ICM (SWMU P-11).

Due mainly to the localized disposal of similar waste materials resulting in geographic grouping of the SWMUs in conjunction with localized groundwater discharge patterns previously identified, groundwater quality is best characterized on a Discharge Area-by-Discharge Area basis with a special emphasis given to monitoring downgradient groundwater prior to discharge into adjacent surface water receptors (i.e., Lake Erie, Smokes Creek, and the Ship Canal). For purposes of this Focused CMS, groundwater quality only within Discharge Areas 2B (SWMUs S-11 and S-22) and 3A (SWMU S-24) is impacted by the ATP SWMU Group. The groundwater monitoring network wells within the ATP SWMU Group Areas installed as part of the RFI are sufficient to assess downgradient groundwater quality and flow direction toward Smokes Creek, therefore no additional monitoring wells are planned to be installed as part of this Focused CMS. Additional monitoring wells or replacement of existing monitoring wells may be deemed necessary for post-remedial monitoring purposes.

4.0 DEVELOPMENT OF ALTERNATIVE CORRECTIVE MEASURES

Tecumseh recently completed an ICM to promptly dredge the lower reach of Smokes Creek to mitigate the expansion of the 100-year flood plain in the City of Lackawanna First Ward and fulfill its maintenance obligations under the State Land Patent Agreement. Much of the dredged Creek sediment contains contaminants that are believed to have migrated substantially or at least in part from the ATP SWMU Group located adjacent to the Creek (see Figure 5). Hence, in order to avoid recontamination of Smokes Creek sediment after dredging, the selected remedy must mitigate the continued migration of contaminants from the ATP SWMU Group to the Creek via groundwater discharge and surface water runoff.

The following alternative corrective measures have been developed in consideration of addressing the impacted slag and soil/fill and groundwater in and around the ATP SWMU Group and are further described in more detail in the subsequent sections:

- Alternative 1 – No Action
- Alternative 2 – Construct Individual In-Place Containment Systems
- Alternative 3 – Excavate and Dispose Agitator Sludge Off-Site, and Contain In-Place Acid Tar Pits
- Alternative 4 – Excavate SWMU S-24, Consolidate and Construct Combined In-Place ATP Containment System
- Alternative 5 – Excavate SWMUs S-11, S-22 & S-24 and Consolidate in On-Site Hazardous Waste CAMU
- Alternative 6 – Excavate SWMUs S-11, S-22 & S-24, Stabilize, and Dispose Off-Site

4.1 Alternative 1 – No Action

The No Action alternative is defined as taking no remedial action to address the impacted slag, soil/fill, and groundwater in the ATP and Agitator Sludge SWMUs. The No Action alternative provides a baseline for comparison against the other remedial alternatives and justifies the need for any remedial action. Long-term monitoring of groundwater may be required under this alternative to monitor changes in contaminant concentrations.

4.2 Alternative 2 – Construct Individual In-Place Containment Systems

This corrective measure alternative involves designing and constructing two separate containment systems to isolate the Acid Tar Pits (SWMUs S-11 and S-22) and the Agitator Sludge Area (SWMU S-24) in-place to eliminate direct control with waste fill and to control future contaminant releases to groundwater, Smokes Creek, and the surrounding land. The containment systems would consist of the following three basic components:

- Bentonite/Soil Slurry Walls: Low-permeability vertical subsurface walls would be constructed downgradient of each area to provide lateral containment of waste fill, impacted slag/soil, and groundwater within the SWMUs from the surrounding subsurface environment.
- Groundwater Collection Systems: Groundwater collection systems would be installed to collect leachate and contaminated groundwater and create an inward hydraulic gradient across each slurry wall to further enhance its effectiveness.
- Final Cover Systems: The final cover systems would consist of a geosynthetic clay liner, HDPE geomembrane, geocomposite drainage layer, 18-inch low-permeability barrier soil layer, and 6-inch vegetated soil cover. The final cover system is intended to reduce the infiltration of precipitation, promote storm water runoff, and eliminate the potential for direct contact with the waste fill. The cover system would also incorporate a gas venting system.

4.3 Alternative 3 – Excavate and Dispose Agitator Sludge Off-Site, and Contain In-Place Acid Tar Pits

This corrective measure alternative involves: excavation of the Agitator Sludge Area waste, on-site stabilization, and off-site disposal; and construction of a confined containment system (i.e., slurry wall, groundwater collection and pre-treatment system, and geocomposite cover system) around the Acid Tar Pits (SWMUs S-11 & S-22) to mitigate the continued migration of contaminants to Smokes Creek through the adjacent subsurface soil and groundwater.

All visibly impacted slag, and soil/fill located within the Agitator Sludge SWMU (S-24) would be excavated, transported, and disposed off-site at a commercial hazardous waste treatment, storage and disposal facility (TSDF). Some of the waste fill would require dewatering and stabilizing prior to off-site transport. It is estimated that between 23,000 and

35,000 cubic yards of impacted soil/fill would be excavated from SWMU S-24. Based on this estimate, up to 2,100 truckloads would need to leave the Site. A minimum of 2 months, with an estimated 100 trips per day, would be required to transport this volume of material to the Chemical Waste Management facility in Model City, NY approximately 30 miles from the Site or some other suitable TSDF further away. The trucks would be traveling on high-volume local and regional roads through highly populated areas.

The excavation would require at least partial backfilling with clean soil/fill to stabilize the surrounding fill and subsequently, covered with topsoil, and seeded to promote vegetative growth. It would take approximately 1 month to backfill the excavation with clean soil/fill.

The ATP containment systems would consist of the following three basic components:

- Bentonite/Soil Slurry Wall: A low-permeability vertical subsurface wall would be constructed downgradient of the ATP area to provide lateral containment of waste fill, impacted slag/soil, and groundwater within the ATP SWMUs from the surrounding subsurface environment.
- Groundwater Collection System: A groundwater collection system would be installed to collect leachate and contaminated groundwater and create an inward hydraulic gradient across the slurry wall to further enhance its effectiveness.
- Final Cover System: The final cover systems would be the same as Alternate 2 and consist of a geosynthetic clay liner, HDPE geomembrane liner, geocomposite drainage layer, 18-inch low-permeability barrier soil layer, and 6-inch vegetated soil cover. The final cover system is intended to reduce the infiltration of precipitation, promote storm water runoff, and eliminate the potential for direct contact with the waste fill. The cover system would also incorporate a gas venting system.

4.4 Alternative 4 – Excavate SWMU S-24, Consolidate, and Construct Combined In-Place ATP Containment System

This alternative includes: excavation and consolidation of the Agitator Sludge Area waste to within the combined foot print of SWMUs S-11 and S-22; and construction of a single confined containment system (i.e., slurry wall, groundwater collection , and geocomposite cover system) around the consolidated Acid Tar Pits to mitigate the continued

migration of contaminants to Smokes Creek through the adjacent subsurface soil and groundwater.

All visibly-impacted slag, and soil/fill located within the Agitator Sludge (SWMU S-24) would be excavated and transported to the Acid Tar Pits SWMUs S-11 and S-22) for consolidation. It is estimated that between 23,000 and 35,000 cubic yards of impacted soil/fill would be excavated from SWMU S-24, transported, and consolidated within the combined SWMU S-11 and S-22 footprint. The fill material excavated from SWMU S-24 would be transported using designated on-site trucks and consolidated within the containment cell footprint. Trucks, excavators, or other heavy equipment used to handle contaminated soil/fill from these SWMUs would be decontaminated prior to leaving the Tecumseh Property. Approximately 600 LF of Site Highway 9 would be cordoned off, including the Smokes Creek Bridge on Highway 9, thus restricting traffic and roadway access for project-related travel only during transportation of the agitator sludge fill to the ATP containment cell. This restricted access roadway would be used during transport of materials. Additionally, this access roadway would continue to undergo regular and periodic maintenance, cleaning, and inspection to reduce potential for contaminated run-off impacts. Equipment decontamination facilities and/or methods would be further detailed in design documents.

The containment system that would be designed and constructed to isolate the Acid Tar Pits and consolidated waste from the Agitator Sludge Area would consist of the following three basic components:

- Bentonite/Soil Slurry Wall: A low-permeability vertical subsurface wall to provide lateral containment of waste and groundwater within the cell from the surrounding subsurface environment.
- Groundwater Collection System: To create an inward hydraulic gradient across the slurry wall to collect leachate/groundwater further enhance its effectiveness.
- Final Cover System: The cover system would be the same as Alternatives 2 & 3 and consist of a geosynthetic clay liner, HDPE geomembrane liner, geocomposite drainage layer, 18-inch low-permeability barrier soil layer, and 6-inch vegetated soil cover. The final cover system is intended to reduce the infiltration of precipitation, promote storm water runoff, and eliminate the

potential for direct contact with the waste fill. The cover system would also incorporate a gas venting system.

4.5 Alternative 5 – Excavate SWMUs S-11, S-22 & S-24 and Consolidate in On-Site Hazardous Waste CAMU

Corrective Action Management Units (CAMUs) are special units created under the RCRA program to facilitate treatment, storage, and disposal of hazardous wastes managed for implementing cleanup of polluted sites. The original CAMU applications submitted by BSC in November 2000 proposed two separate CAMUs: one unit designated to contain solid, non-hazardous wastes; and a second unit to contain characterized hazardous wastes. The original non-hazardous Solid Waste (SW) and Hazardous Waste (HW) CAMUs were designed to meet the "grandfathered" qualitative design objectives stated in the 1993 Title 6 New York Codes of Rules and Regulations (NYCRR) §373-2.19(a)(3).

The HW CAMU would consist of a lined facility for the storage of the ATP SWMU Group and other hazardous waste materials; one or more leachate storage tanks; and a treatment/process area. The HW CAMU would be up to 10 acres in size with an adjacent treatment area and the capability of containing up to 390,000 cubic yards of material (Ref. 5). Key conceptual design elements and performance requirements for the HW CAMU include:

- A composite (low-permeability compacted clay soil over 80-mil HDPE geomembrane) liner system demonstrated to be compatible with the wastes to be placed within it. The base of the liner is to be constructed with a minimum slope of 1% with a minimum separation of 10 feet to groundwater.
- A leachate collection system above the base liner that incorporates a geocomposite drainage layer and 12 inches of permeable (>$1x10^{-2}$ cm/sec) granular select fill capable of maintaining a maximum head of 1 foot. Leachate generated during and after filling of cells will be pumped to a leachate storage tank, treated, and discharged to the existing sanitary sewer at the Lackawanna POTW.
- A final cover system would be the same as Alternatives 2-4 with a geosynthetic clay liner, an HDPE geomembrane liner, and geocomposite drainage layer covered with 18 inches of barrier protection soil and 6-inch vegetated topsoil. The cover system would also incorporate a gas venting system.

- A static and seismic analysis of the overall landfill site, sub-base, liner and cover systems.
- A groundwater monitoring system capable of detecting leakage and integrated into the Long-Term Groundwater Monitoring Plan.

Waste pretreatment or stabilization would be implemented in the treatment/process area as necessary, as waste fill is received to render the waste physically and chemically compatible for landfilling.

4.6 Alternative 6 – Excavate SWMUs S-11, S-22 & S-24, Stabilize, and Dispose Off-Site

This alternative would entail excavation of the slag/soil/fill from the Acid Tar Pits and Agitator Sludge Area with transport of the excavated materials to and disposal at an off-site commercial hazardous waste treatment, storage and disposal facility (TSDF). Some of the waste fill would require dewatering and stabilizing prior to off-site transport.

The RFI estimated that between 128,000 and 135,000 cubic yards of contaminated slag, soil, and fill was placed in the SWMUs. A more realistic excavation volume may be as high as 200,000 cubic yards considering likely lateral and vertical migration of wastes since placement, slope stability, and added volume due to stabilization additives for saturated wastes. Based on this estimate, approximately 12,000 truckloads would need to leave the Site. A minimum of 9 months, with an estimated 62 trips per day, would be required to transport this volume of material to the Chemical Waste Management facility in Model City, NY approximately 30 miles from the Site or some other suitable TSDF further away. The trucks would be traveling on high-volume local and regional roads through highly populated areas.

The excavation would require at least partial backfilling with clean soil/fill to stabilize the surrounding fill and subsequently, covered with topsoil, and seeded to promote vegetative growth. It would take approximately 6-9 months to backfill the excavation with borrow soil/slag fill.

5.0 EVALUATION STANDARDS AND CRITERIA

The Alternative Corrective Measures previously identified and developed were evaluated based upon the following standards and criteria.

5.1 Remedial Performance Standards

The remedial alternatives were first screened to determine if they met the following three performance standards:

- Attain applicable environmental media cleanup standards and objectives.
- Control source(s) of the release(s).
- Protect human health and the environment.

Remedies that met these performance standards were then evaluated using six balancing criteria to identify the remedy that provides the best relative combination of attributes. Each of the above remedial performance standards are discussed in greater detail in the following subsections.

5.1.1 Attain Media Cleanup Standards

This performance standard refers to the ability of the remedial alternative to achieve applicable New York State groundwater quality standards and soil cleanup objectives. It does not necessarily mean removal or treatment of all fill material above specific constituent concentrations is required. Remedial alternatives may attain media cleanup standards through combinations of removal, treatment, and engineering and institutional controls. Applicable site-specific engineering controls may include:

- Containment systems such as slurry walls and/or geosynthetic and soil cover systems.
- Groundwater collection systems.
- Groundwater treatment (in-situ or ex-situ) systems.

Applicable institutional controls may include:

- Long-term groundwater monitoring and reporting.
- Environmental easements and restrictive covenants.

Attainment of groundwater cleanup standards typically takes years following implementation of remedial measures. As is often the case, attainment of groundwater cleanup standards for all parameters may not be achievable based on background groundwater quality and other site-specific issues. The fact that other SWMUs requiring corrective measures in the CMS Area also contribute to groundwater quality in the vicinity of the ATP SWMU Group suggests compliance with groundwater quality standards downgradient of the ATP Group may not be readily achievable following implementation of corrective measures. As groundwater is currently not used on-site for potable purposes; abundant public water supply is available on-site; and deed restrictions prohibit use of on-site groundwater, there is no immediate need for on-site groundwater to fully comply with all New York State Groundwater Quality Standards, provided that public health and the environment are protected.

The primary consideration regarding groundwater quality in the vicinity of the ATP SWMU Group is the protection of surface water and sediment quality in adjacent Smokes Creek. The degree of protection can be measured and monitored based on the (reduction in) mass loading (in pounds per day) of constituents of concern in groundwater discharge in the vicinity of the ATP SWMU Group to Smokes Creek. Post-remediation monitoring of surface water and sediment in the Creek can also verify adequate protection.

5.1.2 Control the Sources of Releases

Alternative corrective measures are assessed as to what degree they reduce or eliminate further releases of constituents of concern to groundwater and the surrounding environs. This can be measured and monitored based on the (reduction in) mass loading (in pounds per day) of constituents of concern in groundwater discharge in the vicinity of the ATP SWMU Group to Smokes Creek. Post-remediation monitoring of surface water and sediment in the Creek can also verify the effectiveness of source controls.

5.1.3 Protect Human Health and the Environment

This performance standard refers to how remedial alternatives provide human health and environmental protection. The primary public health and environmental routes of exposure for the ATP SWMU Group is direct contact with the waste fill, migration via overland flow (e.g., resulting from storm water erosion and run-off) and contaminated groundwater flow to the adjacent Creek. The degree of protection can be measured and monitored based on the (reduction in) mass loading (in pounds per day) of constituents of concern in groundwater discharge in the vicinity of the ATP SWMU Group to Smokes Creek. Post-remediation monitoring of surface water and sediment in the Creek can also verify adequate protection.

5.2 Balancing Criteria

Remedial alternatives that met performance standards were then evaluated relative to the following six balancing criteria:

- **Long-term reliability and effectiveness:** The factors to be evaluated include the magnitude of residual risk (measured by standards such as reduction in off-site contaminant loadings and associated risk reduction), and the adequacy and long-term reliability of controls that may be required to manage the risk posed by residual contamination. There is a preference for treatment over containment, where appropriate; however, this criterion does not preclude protective containment remedies.
- **Reduction of toxicity, mobility, or volume of wastes:** The factors to be evaluated include: the treatment or containment process used and constituents of concern; the amount of hazardous materials destroyed, treated, or immobilized; the degree of expected reduction in toxicity, mobility, or volume; the degree to which treatment, containment, or stabilization is irreversible; and the type and quantity of residuals remaining after treatment or containment.
- **Short-term effectiveness:** This criterion addresses the effects of the alternative during the remedial construction and implementation phase. Each alternative is evaluated with respect to: protection of the community during remedial actions (e.g., transportation-related and fugitive emission risks); protection of workers during remedial actions; environmental impacts (e.g., disturbance of the site or environs); and the time until remedial action objectives are expected to be achieved.

- **Implementability:** The factors to consider include: the ability to construct and operate the technology; the reliability of the technology with regard to technical practicability; ease of undertaking additional corrective measures if necessary; the ability to monitor the effectiveness or the remedy; the coordination with other agencies and the community; the availability of off-site treatment, storage, and disposal services and specialists; and the availability of prospective technologies.
- **State and community acceptance:** The alternative should consider the current and reasonably anticipated use of that portion of the CMS Site and related zoning and land use plan.
- **Cost:** This criterion addresses the capital costs; annual operation, maintenance, and monitoring costs (OM&M); and present worth analysis for the anticipated life of the remedy. In comparing remedial alternatives, the less costly remedy that offers equivalent protection can be selected; however, protection cannot be traded for cost.

6.0 EVALUATION OF ALTERNATIVE CORRECTIVE MEASURES

6.1 Performance Standard Analysis

In comparing the six alternative corrective measures listed in Section 4.0 to the performance standards outlined in Section 5.1, Alternative 6 – Excavate SWMUs S-11, S-22 & S-24, Stabilize, and Dispose Off-Site – would not be protective of human health and the environment in the near term.

Alternative 6 would entail excavation of massive quantities of contaminated slag/soil/fill from the Acid Tar Pits and Agitator Sludge Area with transport of the excavated materials to and disposal at an off-site commercial hazardous waste treatment, storage and disposal facility (TSDF). Some of the excavated waste fill material would require dewatering and stabilizing prior to off-site transport. The additional handling of this highly contaminated material would put Site workers and the environment at risk during remedial construction. Based on the estimated 200,000 cubic yards of contaminated slag, soil and fill (much of which would be considered a hazardous waste), approximately 12,000 truckloads would need to leave the Site. A minimum of 9 months, with an estimated 62 trips per day, would be required to transport this volume of material to the Chemical Waste Management in Model City, NY TSDF approximately 30 miles from the Site. The trucks would be traveling on high-volume local and regional roads through highly populated areas. Off-site transport of this waste would put the community and the environment at risk. The excavation would be required to be at least partially backfilled with clean soil/slag fill to stabilize the surrounding fill and subsequently, covered with topsoil, and seeded to promote vegetative growth. It would take approximately 6-9 months to backfill the excavation with clean soil/slag fill; and increase truck traffic at the foot of Ridge Road and along NYS Route 5 in the City of Lackawanna and possibly in the Town of Hamburg and/or the City of Buffalo west and east of the Site, respectively. Furthermore, the estimated cost of Alternative 6 is $52.7 million (Table 7), which is economically not feasible.

Although the No Action Alternative would not be protective of human health and the environment, it has been included in Section 6.2 for baseline comparison. The four remaining remedial alternatives that do meet the performance standards outlined in Section 5.1 are further evaluated below using the balancing criteria introduced in Section 5.2.

6.2 Balancing Criteria Analysis

6.2.1 Alternative 1 – No Action

Long-term reliability and effectiveness: The No Action alternative provides no measures to: remediate soil/fill contaminants; control soil/fill contaminant migration via surface erosion or leaching to groundwater; or to eliminate the potential for direct contact with the waste fill. All current and future environmental and public health risks associated with the ATP SWMU Group would remain unchanged under this alternative.

Reduction of toxicity, mobility, or volume of wastes: This alternative provides no reduction in toxicity, mobility, or volume of COPCs in slag/soil/fill or groundwater.

Short-term effectiveness: The No Action Alternative is not effective in reducing or controlling environmental or public health risks in the short-term.

Implementability: No technical implementability issues or action-specific administrative implementability issues are associated with this alternative.

State and Community Acceptance: Taking no action to address the highly contaminated waste within these SWMUs would not be acceptable to the State and community. The No Action Alternative is not consistent with the reasonably anticipated future use of this portion of the CMS Site for passive recreation.

Cost: No capital costs are associated with the No Action Alternative. Continued groundwater monitoring may be required to monitor changes in COPC concentrations. The annual cost for this monitoring is estimated to be $15,000, with a 30-year present worth cost estimated at $231,000.

6.2.2 Alternative 2 – Construct Individual In-Place Containment Systems

Long-term reliability and effectiveness: The highly contaminated slag/soil/fill within SWMU S-11, S-22 and, to a lesser extent, S-24 must be contained (if not removed) to reduce or substantially eliminate continued migration of soluble contaminants in groundwater from the SWMUs to the Creek. Due the immediate proximity of SWMU S-24 to Smokes Creek and the relatively small estimated quantity of waste in SWMU S-24, containment in place is not desirable from a long-term reliability perspective or from a long-term operation and maintenance perspective. Armoring of the Creek bank adjacent to SWMU S-24 may be necessary to prevent floodwater erosion into the containment cell, thus protecting it from a structural breach and associated release of waste constituents to the Creek and possibly Lake Erie.

Reduction of toxicity, mobility, or volume of wastes: Placement of slurry walls, groundwater collection wells and geocomposite cover systems would significantly reduce the mobility of contaminants due to soil erosion, significantly reduce surface water infiltration and resultant constituent leaching from contaminated fill, and would contain and capture contaminated groundwater/leachate within the SWMUs. Groundwater that has already migrated away from the SWMUs outside the slurry wall would not be affected by this alternative. The toxicity and volume of contaminants would be slowly reduced under this alternative as aqueous phase constituents in groundwater/leachate within the containment are collected and treated on or off-site.

Short-term effectiveness: The proximity to Smokes Creek and estimated depth of waste fill in SWMU S-24 dictates that storm water management measures and soil/sediment erosion controls be planned and employed during excavation and construction of the slurry wall. The following short-term construction impacts would require mitigation:

- Transport of contaminated storm water and/or sediment to Smokes Creek.
- Intrusion of Creek water into the excavation, especially during storm events or flood conditions.
- Groundwater dewatering, treatment and disposal during excavation of saturated waste fill at depth.

- Smokes Creek bank restoration and post-remediation erosion protection.
- Mitigation of fugitive dust from excavation and material handling

This alternative is estimated to require two or possibly three construction seasons (approximately 19-30 months) to implement, with winter and early spring suspension of construction due to inclement weather.

Implementability: No significant technical implementability issues or action-specific administrative implementability issues are associated with this alternative. Armoring of the Creek bank adjacent to SWMU S-24 would likely be required to prevent floodwater erosion into the containment cell, thus protecting it from a structural breach and associated release of waste constituents to the Creek and possibly Lake Erie.

State and Community Acceptance: Containment of the waste in place would likely be acceptable to the State and community as the hazardous waste remains contained on-site with no additional handling. Passive recreation is the proposed future use for these areas, which is consistent with the final vegetated geocomposite cover systems proposed.

Cost: The estimated capital cost for this Alternative 2 is $4.4 million. Annual OM&M costs for maintenance of the groundwater/leachate collection and pretreatment systems, groundwater monitoring, and cover maintenance are estimated at $155,000; resulting in an overall estimated present worth cost of $6.8 million.

6.2.3 Alternative 3 – Excavate and Dispose Agitator Sludge Off-Site, and Contain In-Place Acid Tar Pits

Long-term reliability and effectiveness: Construction of the geocomposite final cover systems over the ATP areas SWMUs S-11 and S-22 would prevent soil/fill contaminant migration via surface erosion and prevent direct contact with the highly-contaminated soil/fill within them. The slurry wall in conjunction with the internal groundwater collection system would mitigate further lateral subsurface migration of contaminants from SWMUs S-11 and S-22. To provide for long-term permanence of this

alternative, regular inspection and maintenance of the soil and vegetative cover would be required to assure cover integrity. Downgradient groundwater monitoring would be required to confirm the effectiveness of the slurry wall and groundwater collection system.

The removal of contaminated slag/soil/fill within SWMU S-24 would substantially eliminate continued migration of soluble contaminants in groundwater to the Creek.

Reduction of toxicity, mobility, or volume of wastes: Placement of slurry walls and cover systems would significantly reduce and substantially eliminate the mobility of contaminants due to soil erosion, reduced surface water infiltration, and groundwater containment within the ATP SWMUs. Groundwater that has already migrated away from the ATP SWMUs would not be affected by this alternative. The toxicity and volume of contaminants in SWMUs S-11 and S-22 would not be reduced under this alternative. With stabilization of the SWMU S-24 waste, the toxicity and mobility of contaminants would be reduced; however, the volume would be increased due to the material that would be necessary to render the material physically stable for off-site disposal.

Short-term effectiveness: The proximity of SWMU S-24 to Smokes Creek and estimated depth of waste fill dictates that storm water management measures and soil/sediment erosion controls be planned and employed during excavation and backfill of the Agitator Sludge. Such measures and controls would be necessary to mitigate the following short-term impacts during construction:

- Transport of contaminated storm water and/or sediment to Smokes Creek.
- Intrusion of Creek water into the excavation, especially during storm events or flood conditions.
- Groundwater management and handling during excavation.
- Smokes Creek bank restoration and post-remediation erosion protection.

Construction workers would be exposed to the contaminated slag/soil/fill and possibly dust during excavation of the agitator sludge from SWMU S-24 and during slurry wall and final cover system construction of the containment cell around the ATPs. These short-term worker exposure risks can be effectively managed through the use of personal protective

equipment (PPE) and dust suppression methods. Despite strict adherence to the Health and Safety Plan, transportation of the SWMU S-24 excavated waste off-site poses a potential risk to the community and the environment resulting from spillage or releases from a traffic accident. Material deliveries are not significant relative to the heavy traffic that already exists on NYS Route 5. Noise from heavy equipment used to construct the remedy would not be noticeable at the nearest off-site receptors located over ½-mile from the ATP SWMUs. This alternative is estimated to require two or possibly three construction seasons (approximately 19-30 months) to implement, with winter and early spring suspension of construction due to inclement weather.

Implementability: No significant technical implementability issues or action-specific administrative implementability issues are associated with covering in-place the ATP areas. Some of the waste from SWMU S-24 would likely require stabilization prior to off-site disposal. Technical implementability issues associated with ex-situ stabilization include the need to: identify an effective stabilizing agent for the constituents; and employ a specialty contractor during the work. Dewatering of SWMU S-24 during excavation will likely be required.

State and Community Acceptance: Containment of the ATP waste in place is expected to be acceptable to the State and community as the hazardous waste would be contained with minimal disruption within a relatively short period of time. Off-site disposal of the waste from SWMU S-24 would likely be acceptable to the State and community; however, concerns over hauling the wastes off-site may arise. Passive recreation is the proposed future use for the ATP area, which is consistent with the final vegetated geocomposite cover systems proposed. Removal of the Agitator sludge from SWMU S-24 would render this area suitable for recreation, commercial or industrial use.

Cost: The estimated capital cost for this alternative is approximately $14.6 million. Annual OM&M costs for maintenance of the groundwater/leachate collection and pretreatment systems, groundwater monitoring, and cover maintenance are estimated at $155,000; resulting in an overall estimated present worth cost of $17.0 million.

6.2.4 Alternative 4 – Excavate SWMU S-24, Consolidate and Construct Combined In-Place ATP Containment System

Long-term reliability and effectiveness: Construction of the vegetated geocomposite cover system over the consolidated ATP containment area surrounding SWMUs S-11 and S-22 would prevent soil/fill contaminant migration via surface erosion and prevent direct contact with the contaminated soil/fill. To provide for long-term permanence of this alternative, regular inspection and maintenance of the soil and vegetative cover would be required to assure cover integrity. Downgradient groundwater monitoring would be required to confirm the effectiveness of the slurry wall and groundwater collection system. Residual groundwater impacts downgradient of the consolidated ATP containment cell may require additional groundwater treatment and/or control measures if deemed necessary to protect Smokes Creek water quality.

Reduction of toxicity, mobility, or volume of wastes: Placement of a composite geomembrane and vegetated soil cover system would reduce the mobility of contaminants due to soil erosion and reduced surface water infiltration. The toxicity and volume of contaminants would not be reduced under this alternative. The slurry wall in conjunction with the groundwater collection system around the consolidated wastes in the ATPs would substantially mitigate further subsurface migration of contaminants from the ATP SWMUs.

Short-term effectiveness: The proximity of SWMU S-24 to Smokes Creek and estimated depth of waste fill dictates that storm water management measures and soil/sediment erosion controls be planned and employed during excavation and backfill of the Agitator Sludge. Such measures and controls would be necessary to mitigate the following short-term impacts during construction:

- Transport of contaminated storm water and/or sediment to Smokes Creek.
- Intrusion of Creek water into the excavation, especially during storm events or flood conditions.
- Groundwater management and handling during excavation.

- Smokes Creek bank restoration and post-remediation erosion protection.

Construction workers would be exposed to contaminated slag/soil/fill and dust during excavation of the contaminated soil/fill and placement of the soil cap; however, these exposure risks can be managed through the use of personal protective equipment (PPE) and dust suppression methods. No significant risks to the off-site community are anticipated under this alternative as all material remains on-site, far removed from the community. Material deliveries are not significant relative to the heavy traffic that already exists on NYS Route 5. Noise from heavy equipment used to construct the remedy would not be noticeable at the nearest off-site receptors located over ½-mile from the ATP SWMUs. The Remedial Action Objectives would be achieved once the vegetative cover is established (est. 16 months).

Implementability: Similar to Alternatives 2 and 3, no significant technical implementability issues or action-specific administrative implementability issues are associated with this Alternative. Dewatering of these areas during excavation will likely be required.

State and community acceptance: Consolidation of the agitator sludge in the Acid Tar Pits is expected to be acceptable to the community as the hazardous waste would be contained with minimal disruption within a relatively short period of time. In addition, this alternative would result in only one contaminant cell on the south side of Smokes Creek instead of two to three separate units on both sides of the Creek as proposed under Alternative 2. It would also substantially reduce the likelihood of recontamination of Smokes Creek that may occur under the substantially delayed consolidation approach in the HW CAMU proposed under Alternative 5. Passive recreation is the proposed future use for the Acid Tar Pits area, which is consistent with the final vegetated cover system proposed.

Cost: The estimated capital cost for this alternative is $3.3 million. Annual OM&M costs for maintenance of the groundwater/leachate collection and pretreatment systems, groundwater monitoring, and cover maintenance are estimated at $140,000; resulting in an overall estimated present worth cost of $5.5 million.

6.2.5 Alternative 5 – Excavate SWMUs S-11, S-22, & S-24 and Consolidate in On-Site Hazardous Waste CAMU

Long-term reliability and effectiveness: Consolidation of the ATP Group waste in the HW CAMU will provide a reliable and effective approach for the long-term protection of human health and the environment. Residual groundwater impacts may remain beneath and downgradient of the excavated SWMUs. Therefore, additional groundwater treatment and/or control may be required following excavation of the waste materials if deemed necessary to protect Smokes Creek water quality.

Reduction of toxicity, mobility, or volume of wastes: The HW CAMU will minimize future releases by construction of a geosynthetic liner under and a geosynthetic and vegetated soil cover system over the wastes. The degree of reduction of cover system infiltration and potential leaching to the groundwater and/or surrounding environment will be minimized under this alternative. The toxicity of the hazardous materials may be decreased as pre-treatment of the waste via stabilization may be required prior to consolidation. Depending on the stabilization method used, the volume of waste may increase due to the stabilization materials added. The degree of mobility of waste leachate to groundwater and/or the surrounding environment is significantly reduced under this Alternative as a result of the efficient liner and leachate collection system.

Short-term effectiveness: All activities associated with the HW CAMU would be conducted in accordance with approved Health and Safety and Contingency Plans to control short-term exposure associated with implementation and closure of the units. Construction workers would be exposed to contaminated slag/soil/fill and dust during excavation of the contaminated soil/fill; placement of the waste in the HW CAMU; and placement of the cover system. However, these exposure risks could be managed through the use of personal protective equipment (PPE) and dust suppression methods. No significant risks to the off-site community are anticipated under this alternative as all material remains on-site at great distances from the surrounding community. Despite strict adherence to these plans, excavation and on-site transportation of these hazardous wastes (particularly associated with SWMUs S-11 and S-22) pose a potential risk to site workers and the environment during the remediation work. The wastes within the three SWMUs would therefore remain in place

without control during the time required to complete the CMS; design and construct the CAMU; and excavate and place the material in the CAMU. The estimated timeframe to accomplish all these activities is approximately 5-6 years. Such a prolonged implementation period significantly increases the risk of recontamination of Smokes Creek.

Implementability: It is estimated that a total of approximately 200,000 cubic yards of impacted soil/fill would be excavated from SWMUs S-11, S-22, and S-24. Some of the waste from the Acid Tar Pits would likely require stabilization prior to consolidation. Technical implementability issues associated with this Alternative include: stabilizing and shoring the deep excavation of SWMUs S-11 and S-22; testing and removal of waste and soil, slag and fill contaminated by wastes adjacent to the SWMU; dewatering of the Excavation; and treatment of contaminated water removed from the excavation. The implementation of this alternative is complex and uncertain given the time, regulatory requirements, and construction requirements related to the HW CAMU.

State and community acceptance: The final HW CAMU is expected to be acceptable to the community; however, excavation and handling of large volumes of hazardous waste may be viewed as an unnecessary risk to the community, workers, and the environment when other less-risky alternatives are feasible. Passive recreation is the proposed future use for the area proposed for the HW CAMU and surrounding Slag Fill Area (SFA)- Zone 2 lands. Based on the current state of this portion of the site, and in accordance with 6 NYCRR Part 373, SFA- Zone 2 is considered to be the best location for the HW CAMU. The Department has already deemed the HW CAMU application substantially complete.

Cost: The 30-year present worth cost of this remedial alternative is estimated to be $14.5 million, with a projected $13 million for capital expenditures and $100,000 of annual OM&M costs for groundwater monitoring and maintenance of the CAMU cover and leachate collection systems.

6.3 Comparative Analysis of Remedial Alternatives

In this section, the remedial alternatives are compared to one another against each of the balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each of alternatives. The four remedial alternatives compared are:

- Alternative 2 – Construct Individual In-Place Containment Systems
- Alternative 3 – Excavate and Dispose Agitator Sludge Off-Site, and Contain In-Place Acid Tar Pits
- Alternative 4 – Excavate SWMU S-24, Consolidate and Construct Combined In-Place ATP Containment System
- Alternative 5 – Excavate SWMUs S-11, S-22, & S-24, and Consolidate in On-Site Hazardous Waste CAMU

Long-term reliability and effectiveness: The proximity of SWMU S-24 to Smokes Creek and the relatively small estimated quantity of waste in SWMU S-24 make Alternative 2less desirable than the other alternatives from a long-term reliability and effectiveness perspective. Excavation and off-site disposal (Alternative 3); consolidation in the Acid Tar Pits (Alternative 4); and HW CAMU (Alternative 5) will provide reliable and effective approaches for handling these materials in an engineered manner protective of human health and the environment. Residual groundwater impacts may remain beneath and/or downgradient of the excavated or contained SWMUs; therefore, groundwater collection from within the containment cells (Alternatives 3 and 4) or CAMU (Alternative 5) and groundwater treatment is planned for these three alternatives. Construction of the final cover systems (Alternatives 2 through 4) would prevent soil/fill contaminant migration via surface erosion and prevent direct contact with the contaminated soil/fill. To assure the long-term reliability and effectiveness of Alternatives 2 through 4, regular inspection and maintenance of the soil and vegetative layers would be required to assure cover integrity. Alternatives 3 and 4 are considered comparable in effectiveness and reliability due to the removal of agitator sludge from S-24 in both cases. Downgradient groundwater monitoring would be required to confirm the effectiveness of the slurry wall (Alternatives 2 through 4) and groundwater/leachate collection systems (Alternatives 2 through 5). Alternative 5 is considered slightly more reliable and effective in the long-term than the other Alternatives due to the HW CAMU's more efficient engineered liner and leachate collection system. This

is off-set s by implementation concerns and significant implementation delays that threaten to recontaminate Smokes Creek.

Reduction of toxicity, mobility, or volume of wastes: All four alternatives will effectively reduce mobility of the ATP waste. Alternative 2 will maintain the current volume of waste. The volume may be slightly increased as a result of pre-treatment, depending on chosen stabilization techniques that may be required for Alternatives 3, 4 and 5, while the toxicity of the hazardous materials will likely decrease from waste stabilization. Alternative 4 is considered comparable to Alternatives 2 and 3 in terms of reduction of toxicity, mobility, and volume of wastes. Alternatives 3 and 4 are considered better than Alternative 2 in terms of reduction of mobility due to the removal of agitator sludge from S-24.

Short-term effectiveness: Alternative 2 poses the least short-term impacts of the three alternatives since the only excavation required is for placement of the slurry wall. Alternative 2 would also require the least time to implement. Alternatives 3 and 4 both require excavation of SWMU S-24 posing a potential risk to site workers, which would be controlled with proper use of PPE and other health and safety measures. Alternative 3poses a risk to the off-site community and environment as the waste would be transported off-site. Alternative 5 is much less effective in the short term compared to Alternatives 2, 3 and 4 as it will take 5-6 years to implement and, thus, significantly increases the potential to recontaminate the recently dredged Smokes Creek. Alternative 4 is considered comparable to Alternative 2 and slightly better than Alternative 3 in terms of short-term effectiveness due to the fact that no wastes would be transported off site. As such, short-term potential exposure risks to the surrounding community related to the transportation and off-site disposal of agitator sludge (Alternative 3) would be avoided under Alternative 4.

Implementability: All four alternatives are considered technically implementable. Compared to the other alternatives, implementation of Alternative 5 is the most complicated and will take much more time to implement with greater probability of construction issues associated with the CAMU and the massive waste excavation volumes.

State and community acceptance: Containment of the impacted soil/fill in place (Alternative 2) would likely be acceptable to the community as the hazardous waste remains contained on-site with no additional handling. Consolidation of the Agitator Sludge waste in the Acid Tar Pits (Alternative 4) would also likely be acceptable to the community as the hazardous waste is confined to one smaller on-site area with minimal excavation processing. Excavation followed by off-site disposal of the Agitator Sludge waste and containment of the ATP areas (Alternative 3) would likely be acceptable to the community; however, concerns may be raised over the hauling of some of the waste off-site. Passive recreation is the proposed future use for these areas, which is compatible with the same final vegetated soil and geocomposite cover system proposed for all of the Alternatives. Alternatives 2 through4 can be implemented quickly and therefore protect the water quality in Smokes Creek and Lake Erie. Alternative 5 may be acceptable to the community; however, excavation and handling of that large volume of hazardous waste may be viewed as an unnecessary risk to the community, workers, and the environment when other less risky alternatives are feasible. The long implementation time frame for Alternative 5 does not protect Smokes Creek and Lake Erie in the near term and is therefore much less desirable than the other three alternatives.

Cost: The 30-year present worth cost of Alternatives 3 and 5 are estimated at $17.0 million and $14.5 million, respectively, which are far more costly than Alternatives 2 and 4, with present worth costs of $6.8 million and $5.5 million, respectively. Alternatives 2 and 4 are within Tecumseh's Environmental Reserve estimates.

7.0 DESCRIPTION OF PREFERRED REMEDIAL ALTERNATIVE

7.1 General

The preferred corrective measures (Alternative 4) to be implemented for the ATP SWMU Group is to remove, transport, and consolidate the waste from the Agitator Sludge Area (SWMU S-24) to within the combined foot print of the Acid Tar Pits (SWMU S-11 and S-22), and construct a containment cell surrounding the consolidated waste deposition area. A single containment cell at this location is preferable as it is: further from Smokes Creek and out of the flood plain; has more desirable subsurface soil confining conditions; will result in less excavation and handling of hazardous materials than relocation of the combined impacted materials from the ATP SWMU Group to a separate location (e.g., proposed hazardous waste CAMU); can address both impacted soil/fill and groundwater at the Acid Tar Pits; is adjacent to the planned CAMUs in the Zone 2 elevated Slag Fill Area where other solid and hazardous wastes will be permanently contained in place; and it has a smaller footprint with less cover system area which reduces infiltration and long-term operation and maintenance cost.

This preferred alternative will promptly mitigate migration of contaminants through the adjacent subsurface soil and groundwater into Smokes Creek, thus reducing the groundwater contaminant load to Smokes Creek and Lake Erie and potential recontamination of Smokes Creek sediments. This alternative proposed for the ATP SWMU Group in combination with the recently completed Smokes Creek dredging ICM is anticipated to substantially and permanently address public health and the environment concerns related to these high-priority SWMUs and water bodies under the RCRA Corrective Action Program. A summary of the preferred alterative is provided in the following sections.

7.2 Excavation, Consolidation and Backfill Agitator Sludge SWMU

Approximately 23,000 to 35,000 cubic yards (CY) of impacted soil/fill will be excavated from SWMU S-24, transported, and consolidated within SWMU S-11 & S-22. Storm water management measures and soil/sediment erosion controls be planned and employed during excavation and backfill. Approximately 600 LF of Site Highway 9 will be

cordoned off, including the Smokes Creek Bridge, thus restricting traffic and roadway access for project-related travel only during transportation of the agitator sludge fill to the ATP containment cell. Following completion of all visibly impacted soil/fill, verification sampling and analysis will be performed to determine residual concentrations of constituents of concern in soil/fill at the base and sidewalls of the excavation. Backfill material will be placed and compacted in approximate 12-inch lifts with a backhoe bucket or other methods approved by the field inspector or resident engineer.

7.3 Combined In-Place Containment System

The containment system that will be designed and constructed will consist of a bentonite/soil slurry wall, groundwater collection system, and a geocomposite vegetated soil cover system.

In-place lateral containment of the combined & consolidated ATP SWMU Group soil/fill and groundwater will be accomplished by constructing a low-permeability[1] barrier wall around the perimeter for the entire consolidated waste area. The low-permeability barrier wall will be constructed using off-site borrow soil amended with bentonite and/or other soil amendments (type and weight ratio to be determined during design). The proposed barrier wall will function as a physical and lateral hydraulic barrier to isolate the highly-impacted soil/fill and groundwater within the containment cell from the surrounding groundwater and soil/fill. The base of the barrier wall will be keyed a minimum of two feet into the underlying, native lacustrine clayey-silt soil, which will function as a vertical confining layer.

A network of collection wells and/or sumps will be installed within the containment area at intervals and depths to be determined during design. These wells and/or sumps will be constructed and installed in conjunction with the low-permeability slurry wall and cover system to collect containment cell groundwater and/or leachate for treatment as well as to create an inward hydraulic gradient toward the containment cell.

A low-permeability cover system is proposed over the containment cell to reduce the amount of surface infiltration and eliminate direct exposure to impacted soil/fill within the containment cell. The containment cell cover system will be constructed ofa geosynthetic

[1] Barrier wall permeability design specification is $1x10^{-7}$ cm/sec,

clay liner (GCL), an HDPE geomembrane, and a geocomposite, covered by 18 inches of barrier protection material and a 6-inch vegetative soil layer. Soil and slag fill materials will be placed and graded above the waste materials to promote storm surface water runoff and reduce infiltration. Fill materials within the containment will be disturbed as little as possible.

7.4 Operation, Monitoring & Maintenance

Following construction, several elements of the proposed remedial action will require periodic and/or routine operations & maintenance. An Operation, Monitoring, and Maintenance Manual (OM&M Manual) will be prepared during construction and be submitted to NYSDEC prior to completion of construction. This OM&M Manual will include, but not be limited to, discussion of:

- Operation and maintenance of the groundwater/leachate collection system within the consolidated ATP containment cell.
- Operation, maintenance, and monitoring of the groundwater/leachate pretreatment system (if required).
- Routine groundwater water level monitoring and reporting within the contaminated cell.
- Groundwater monitoring upgradient and downgradient of the containment cell.
- Periodic inspection of the cover system.
- Maintenance and repair of the cover system, including repair of erosion and mowing of the vegetative cover.

7.5 Cost

The estimated capital cost of preferred Alternative 4 is $3.3 million. The estimated annual operation, maintenance, and monitoring costs are $140,000. The 30-year present worth cost of preferred Alternative 4 is estimated to be $5.5 million.

8.0 SCHEDULE OF PREFERRED ALTERNATIVE

Two full construction seasons will be necessary to implement this remedy. The first year will focus on building a slurry wall, while the second year will focus on the construction of the containment cell and its final cover system. Major tasks are planned over the two years as follows:

- NYSDEC review/finalize ICM Work Plan (30 days)
- Public Comment Period (45 days)
- Prepare and Execute Contract Documents, mobilize (30-45 days)
- Construct containment cell slurry wall (5-7 months)
- (Winter 2009 shut down)
- (Spring – Summer 2010) Excavate SWMU S-24, consolidate in containment cell, and backfill S-24 (3 months)
- Final grade containment cell and install cover system (4 months)
- Install groundwater/leachate collection wells and monitoring wells (1 month)
- Downgradient groundwater monitoring in accordance with the NYSDEC-approved Long-Term Groundwater Monitoring Plan (LTGWM Plan) presented as Appendix E to the CMS Work Plan (March 2009) (30 days following final closure)
- Replacement wells, if necessary, installed in accordance with the LTGWM Plan (within 60 days of substantial completion of remedial construction)

9.0 REFERENCES

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4. Bethlehem Steel Corporation (BSC). 1994. *Groundwater Monitoring Sampling and Analysis Plan, HWMU-1 and HWMU-2*. Lackawanna, NY. March.

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