Beazer East, Inc.
Pittsburgh, Pennsylvania

Focused Corrective Measures Study

Koppers Inc. Facility
Superior, Wisconsin

March 2004
Revised July 2007

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Superior, Wisconsin

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Certifications

I, Stephen Garbaciak, Jr., hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.

WISCONSIN STEPHEN D. GARBACIAK, JR. E-34840-006 MOKENA IL PROFESSIONAL ENGINEER

Stephen Garbaciak, Jr. Vice President

I, Robert J. Anderson, hereby certify under penalty of law that I am a hydrogeologist as defined in s. NR 600.03, Wis. Adm. Code, and that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

WISCONSIN ROBERT J. ANDERSON PG-1037 CRANBERRY TWP. PA PROFESSIONAL GEOLOGIST

Robert J. Anderson, Vice President

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Acronyms and Abbreviations

AMEC	AMEC Earth & Environmental, Inc.
BaP-TE	benzo(a)pyrene toxic equivalents
BBL	Blasland, Bouck & Lee, Inc. (now known as ARCADIS BBL)
Beazer	Beazer East, Inc.
bgs	below ground surface
CAMU	Corrective Action Management Unit
CAO	Corrective Action Objective
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COPC	constituent of potential concern
cy	cubic yard(s)
DNAPL	dense nonaqueous phase liquid
ES	Enforcement Standard
ETI	Environmental Troubleshooters, Inc.
FTS	Field & Technical Services, LLC
HDPE	high-density polyethylene
KI	Koppers Inc.
LDRs	Land Disposal Restrictions
License	Hazardous Waste Facility Operation License
MTR	Minimum Technology Requirements
NAPL	nonaqueous phase liquid

PAHs	polycyclic aromatic hydrocarbons
PAL	Preventive Action Limit
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
RCRA	Resource Conservation and Recovery Act
RETEC	The RETEC Group, Inc.
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SCM	site conceptual model
SWMU	Solid Waste Management Unit
TCDD-TEQ	2,3,7,8-tetrachlorodibeno-p-dioxin toxicity equivalent
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System

Executive Summary

As part of the ongoing Resource Conservation and Recovery Act (RCRA) Corrective Action activities at the Koppers Inc. (KI) Facility in Superior, Wisconsin (the Site; Figure 1), this *Focused Corrective Measures Study* (Focused CMS Report) has been prepared to identify and evaluate corrective action alternatives to address impacted portions of the Site within and adjacent to the facility boundary (referred to as "on-property" areas). ARCADIS US, Inc. (ARCADIS BBL; formerly known as Blasland, Bouck & Lee, Inc. [BBL]) and AMEC Earth & Environmental, Inc. (AMEC) prepared this report on behalf of Beazer East, Inc. (Beazer), who retains certain environmental liabilities as a result of historical property ownership and business transactions.

The areas targeted by this Focused CMS Report include on-property soils, the Outfall 001 drainage ditch (to the first culvert downstream from the facility boundary) and on-property groundwater. The specific soil areas were developed based on the findings of the *Post-Remediation Human Health Risk Assessment* (Post-Remediation HHRA; AMEC, 2007), which is summarized in Section 4.3 and provided as Appendix A to the Focused CMS Report. The targeted portion of the Outfall 001 drainage ditch was identified as a proactive measure. Specifically, in anticipation of the potential for future corrective action activities in downstream portions of the Outfall 001 drainage ditch (to be evaluated separately), corrective action for the on-property portion of the ditch is contemplated to mitigate the potential future migration of impacted soils and/or potentially mobile, dense nonaqueous phase liquids (DNAPL) that might be present in this area.

This Focused CMS Report is termed "focused" in that it does not extensively evaluate a broad range of potentially applicable corrective action technologies. Rather, based on Beazer's 20-plus years of experience at evaluating and implementing corrective action alternatives at numerous sites impacted by wood-treating operations across the country, the CMS focuses on technologies and alternatives that are known to be successful at addressing similar conditions at other wood-treating sites. This results in a focused set of potential corrective action alternatives for soils and for the portion of the Outfall 001 drainage ditch addressed by this CMS. With respect to groundwater, this Focused CMS Report is "focused" in that it does not identify and evaluate multiple alternatives. Instead, it provides justification for the use of a natural attenuation-based approach that is consistent with Wisconsin regulations and that has been evaluated and supported based on field investigations performed between 2004 and 2007.

The Site-specific Corrective Action Objectives (CAOs) applicable to the portions of the Site addressed within this Focused CMS Report are summarized as follows:

On-Property Soils

- mitigate direct contact by potential receptors to surface soil containing constituents of potential concern (COPCs) at concentrations that may affect human health

- minimize the potential for off-Site migration of COPCs through dissolved-phase transport (groundwater) or erosion (surface water)

Outfall 001 Drainage Ditch

- minimize the potential for direct contact with drainage ditch materials containing COPCs

- minimize the potential for downstream migration of COPCs via the Outfall 001 drainage ditch

On-Property Groundwater

- minimize the potential for off-property migration of impacted groundwater at concentrations exceeding an appropriate Prevention Action Limit (PAL) or Enforcement Standard (ES)

Considering the Site Conceptual Model (SCM), Site-specific CAOs, findings of the Post-Remediation HHRA and results of a technology screening, three corrective action alternatives each were developed for on-property soils and the Outfall 001 drainage ditch. In addition, support for a natural attenuation-based approach to address on-property groundwater is provided. The corrective action alternatives for on-property soils and the Outfall 001 drainage ditch developed for evaluation in this Focused CMS Report are as follows:

Alternative	***Key Components***
Alternatives for On-Property Soils	
Alternative S-1 — Surface Cover	• install a surface cover over the targeted soil areas • conduct periodic post-construction inspections and maintenance • establish baseline institutional controls (described in Section 5.4 of the Focused CMS Report) and additional alternative-specific controls to provide for the continued integrity of the surface cover
Alternative S-2 — Excavation with Placement in an On-Site Corrective Action Management Unit (CAMU)	• construct a CAMU containment cell in a designated area of the Site (as described in Section 5.5 of the Focused CMS Report) • excavate impacted soils in the targeted area • consolidate excavated materials within a CAMU containment cell • backfill and restore the excavation areas to re-establish original surface grades and cover types • conduct periodic post-construction inspections and maintenance • establish baseline institutional controls (described in Section 5.4 of the Focused CMS Report) and additional alternative-specific (related to the CAMU) controls to provide for the continued integrity and effectiveness of the alternative
Alternative S-3 — Excavation with Disposal at an Off-Site Commercial Facility	• excavate impacted soils in the targeted area • transport excavated materials to an appropriately permitted off-Site commercial land disposal facility • backfill and restore the excavation areas to re-establish original surface grades and cover types • conduct periodic post-construction inspections and maintenance • establish baseline institutional controls, as described in Section 5.4

Alternative	Key Components
Alternatives for the Outfall 001 Drainage Ditch	
Alternative D-1 — Culverting the Existing Ditch	• install a high-permeability zone (e.g., crushed stone) with periodic sumps for collection of DNAPL along the bottom of the existing Outfall 001 drainage ditch • install a culvert along the bottom of the Outfall 001 drainage ditch • conduct periodic post-construction inspections to verify the continued effectiveness of the remedy • establish baseline institutional controls, as described in Section 5.4
Alternative D-2 — Excavation and Disposal of Drainage Ditch Materials	• excavate impacted materials along the Outfall 001 drainage ditch • restore excavated channel area to re-establish existing grades and function • conduct periodic post-construction inspections to verify the performance of the remedy • establish baseline institutional controls, as described in Section 5.4
Alternative D-3 — Ditch Relocation with DNAPL Migration Control Measures	• relocate the Outfall 001 drainage ditch to the north of its existing location • install a DNAPL collection system in the existing ditch • conduct periodic post-construction inspections to verify the performance of the remedy • establish baseline institutional controls, as described in Section 5.4

These alternatives, which are described in Section 5, were evaluated relative to the six criteria defined in Sections NR 722.07(4) and NR 722.09(2) of the Wisconsin Administrative Code: long-term effectiveness, short-term effectiveness, implementability, restoration time frame, economic feasibility and compliance with environmental laws, standards and permitting requirements. The result of this evaluation was the selection of an overall corrective action approach for the on-property portion of the Site. The selected corrective action alternatives are as follows:

- install a surface cover to address targeted on-property soils (Alternative S-1)
- culvert the targeted portion of the Outfall 001 drainage ditch (Alternative D-1)

- natural attenuation of on-property groundwater
- establish baseline institutional controls, plus alternative-specific controls associated with the use of a surface cover to address soils

Taken together, installing a surface cover over on-property surface soils targeted for corrective action, culverting the Outfall 001 drainage ditch and natural attenuation of groundwater will achieve all the Site-specific CAOs, and the risk-based objectives discussed in the Post-Remediation HHRA. Further, this approach is effective over both the short and long term, is implementable, can be completed in a reasonable time frame for a reasonable cost and can meet the requirements outlined in applicable environmental laws, standards and permits. Therefore, this approach meets the alternative selection requirements of NR 722.09.

Following approval of the selected corrective action approach by the Wisconsin Department of Natural Resources (WDNR), Beazer will conduct additional activities and investigations to provide the necessary information to design and implement the corrective action approach. The corrective action activities will then be designed, appropriate permits and approvals will be sought, and pertinent design and implementation details will be presented to the WDNR in a Corrective Measures Implementation (CMI) Plan. Pending WDNR approvals, it is Beazer's goal to complete the on-property corrective actions by the end of 2009.

1. Introduction

1.1 Purpose and Scope

This *Focused Corrective Measures Study* (Focused CMS Report) has been prepared as a component of the ongoing Resource Conservation and Recovery Act (RCRA) Corrective Action activities at the Koppers Inc. (KI) Facility in Superior, Wisconsin (Figure 1). While operated by KI, Beazer East, Inc. (Beazer) retains certain environmental liabilities as a result of historical property ownership and business transactions. On behalf of Beazer, this Focused CMS Report has been prepared by ARCADIS U.S., Inc. (ARCADIS BBL; formerly known as Blasland, Bouck & Lee, Inc. [BBL]) and AMEC Earth and Environmental, Inc. (AMEC) for submittal to the Wisconsin Department of Natural Resources (WDNR).

This Focused CMS Report is based upon the findings of various investigations conducted at the KI Facility since 1981, including the RCRA Facility Investigation (RFI) activities conducted in 1990 and 1996. Among other pertinent findings, the previous investigations indicate the presence of wood-treating-related compounds in certain environmental media at the facility (i.e., within the property owned by KI), as well as within and adjacent to a downgradient ditch/tributary and creek on nearby properties. The KI Facility and affected downgradient areas are collectively referred to herein as “the Site.” Based on the findings of previous investigations, the primary constituents of potential concern (COPCs) with respect to the Site are polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol and polychlorinated dibenzo-p-dioxins/ polychlorinated dibenzofurans (PCDDs/PCDFs). [1]

The purpose of this Focused CMS Report is to identify and evaluate potential corrective action alternatives to address impacted media within the on-property portion of the Site and, ultimately, to identify a recommended corrective action approach. To this end, various potential corrective action alternatives are identified in consideration of previous investigation data, current and future land uses, Site-specific factors, corrective action objectives (CAOs) that have been established for the Site, and

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[1] As further discussed in the Post-Remediation Human Health Risk Assessment (Appendix A), other constituents have been detected during various investigations of the on-property portion of the Site and are considered in the risk assessment, but ultimately do not influence the conclusions of the risk assessment.

previous coordination with the WDNR. The scope of the corrective action alternatives is also based on the findings of the *Post-Remediation Human Health Risk Assessment* (Post-Remediation HHRA; AMEC, 2007), which is further discussed within this Focused CMS Report and provided as Appendix A. The evaluation of corrective action alternatives was performed using criteria established in Section NR 722 of the Wisconsin Administrative Code (Standards for Selecting Remedial Actions).

While previous investigations indicate potential wood-treating-related impacts both within and downgradient of the facility boundaries, this focused CMS addresses only that portion of the Site within and immediately adjacent to the facility boundary (hereafter referred to as "on-property" areas). This is based on the consideration that sufficient information exists for this portion of the Site upon which to identify and evaluate potential corrective action alternatives. By comparison, additional activities (e.g., risk assessments) are anticipated in the off-property areas to facilitate identification and evaluation of potential remedial approaches for those areas. In lieu of delaying corrective actions for the on-property areas pending further evaluation of the off-property areas, this Focused CMS Report has been prepared to specifically address only the on-property portions of the Site. Off-property portions of the Site will be addressed separately. This approach was discussed with and approved by the WDNR during a November 21, 2003 meeting with Beazer (BBL, 2003c).

This Focused CMS Report is termed "focused" in that it does not extensively evaluate a broad range of potentially applicable corrective action technologies. Rather, it focuses on technologies and alternatives that are known to be successful at addressing similar conditions at other wood-treating sites. This is reflective of Beazer's 20-plus years of experience at evaluating and implementing corrective action alternatives at numerous sites impacted by wood-treating operations across the country. Many potential alternatives have previously been discussed, reviewed and/or attempted at some scale at other wood-treating sites in the past, and, based on that experience, have not been considered in this Focused CMS Report. This approach results in a focused set of potential corrective action alternatives for soils and the Outfall 001 drainage ditch[2] (see Section 4.4). With respect to groundwater, this

[2] As requested by the WDNR, the term "tributary to Crawford Creek" is now being used to refer to the off-property portion of the surface-water drainage feature previously called the "Outfall 001 drainage ditch." However, the term "Outfall 001 drainage ditch" is still being used to refer to the on-property portion of this surface-water drainage feature (i.e., the portion being addressed in this document).

Focused CMS Report is "focused" in that it does not identify and evaluate multiple alternatives. Instead, it supports the use of a natural attenuation-based approach that is consistent with Wisconsin regulations and guidance, and that has been evaluated and supported based on field investigations performed between 2004 and 2007. This approach to limiting the scope of corrective action options considered was presented to and discussed with the WDNR at meetings in 1996 and 2000, and was specifically described in the Phase III RFI Report. More recently, it was discussed with and agreed upon by the WDNR at November 21, 2003 (BBL, 2003c) and April 11, 2007 meetings between Beazer and WDNR.

1.2 Report Organization

The remaining sections of this Focused CMS Report, which are supported with tables, figures and appendices, are organized as follows.

Section 2 — Site Description and Land Use. This section describes the physical setting and Site history, and summarizes previous investigations pertinent to the identification, evaluation and selection of corrective action alternatives.

Section 3 — Site Conceptual Model. This section describes geologic and hydrogeologic conditions, potential source areas, distribution of COPCs, migration pathways and potential exposure pathways for the on-property portion of the Site.

Section 4 — Corrective Action Goals and Objectives. This section presents the Site-specific CAOs established for on-property soils, the Outfall 001 drainage ditch and on-property groundwater; summarizes the Post-Remediation HHRA; and discusses the areas of the Site targeted for corrective action.

Section 5 — Identification of Corrective Action Alternatives. In this section, a variety of potential corrective action technologies and process options are identified and screened based on considerations of Site-specific feasibility and effectiveness. The retained technologies and process options are then assembled into potential corrective action alternatives to target achievement of the Site-specific CAOs.

Section 6 — Evaluation of Corrective Action Alternatives. This section presents a comparative evaluation of the potential corrective action alternatives with respect to the criteria described in NR 722.07 of the Wisconsin Administrative Code.

Section 7 — Selected Corrective Action Approach. This section identifies the selected corrective action alternatives for on-property soils, the Outfall 001 drainage ditch and on-property groundwater. Rationale for selecting these alternatives is also provided.

Section 8 — References. This section provides a list of documents, correspondence, etc. referred to throughout this Focused CMS Report.

2. Site Description and Land Use

2.1 Physical Setting

The Site is located in a rural, sparsely populated setting in northwestern Wisconsin, approximately five miles southeast of the City of Superior (Douglas County) at the junction of County Roads A and Z (Figure 1). The facility property is approximately 112 acres and is zoned for industrial use. As shown on the Site Plan (Figure 2), the eastern property boundary generally parallels County Road A and the northern property boundary parallels Hammond Avenue. Historical wood-treating operations were located at the north end of the property and the remaining operational portions of the property were primarily used to store treated and untreated wood. Wetland assessment and delineation activities performed in 2002 and 2005 identified approximately 44 acres of wetlands within the Site’s 112-acre property limits (Figure 2).

KI discontinued wood-treating operations at the facility in 2006, and the majority of the buildings and structures associated with the former wood-treating processes were decommissioned in 2006 and 2007. Currently, KI uses the southern portion of the facility for storage, sorting and shipment of untreated railroad ties. A shop and office building remain in the northern portion of the facility. Rail spurs traversing the property are used for delivery and shipment of untreated wood products.

The area surrounding the facility, which has remained relatively unchanged for more than 60 years, is predominantly undeveloped and vegetated with trees, shrubs and grasses. The area to the north, west and northeast of the facility is zoned as a Resource Conservation District. National Wetland Inventory maps indicate that the property is primarily surrounded by wetlands, with the exception of an area zoned for agricultural use located south and southeast of the facility. No county parks, state parks, or fish hatcheries have been identified within a one-mile radius of the facility. Some private residences are located near the southeast portion of the facility on County Road A, and to the north and northeast of the facility along Hammond Avenue and County Road A. A series of railroad tracks run immediately north, west and south of the facility. Crawford Creek, a tributary to the Nemadji River (which discharges to Lake Superior), is located approximately one-half mile northwest of the facility. Surface-water runoff from the majority of the facility drains to Crawford Creek via the Outfall 001 drainage ditch and the tributary to Crawford Creek.

2.2 Site History

Constructed by the National Lumber and Creosoting Company, the facility initiated operation in 1928. The property changed hands through a series of transactions between 1938 and 1988, when Beazer (then the property owner) sold it to KI. While the facility is currently owned by KI, Beazer retains certain environmental responsibilities related to past operations. Wood-treating operations at the facility were discontinued in 2006.

Pressure-treated railroad cross ties, bridge timbers, switch ties and crossing panels were historically produced at the KI Facility. Creosote with a number 6 fuel oil carrier was the primary preservative used at the plant; however, pentachlorophenol with a petroleum oil carrier was also used as a preservative between 1955 and 1979. Four non-RCRA wastewater impoundments were constructed in 1977 and closed in 1982. Two clay-lined RCRA surface impoundments were constructed in 1982 to store wastewater from the wood-treating process, following pretreatment via oil/water separation. The two RCRA surface impoundments were closed in August 1988. Closure certification was submitted to the WDNR in November 1989. Between 1988 and 2006, wastewater from the treating process was treated via oil/water separation, biological activity and aeration, and treated water was evaporated in an evaporation unit.

In September 1988, the United States Environmental Protection Agency (USEPA) issued a RCRA Part B Corrective Action Permit for the Site, which expired in September 1998. In December 1990, a Hazardous Waste Facility Operation License (License) was issued for the Site by the WDNR. The License, which expires in 2020, governs long-term care of the closed RCRA surface impoundments. The License, and a Closure and Long-Term Care Approval, have been the WDNR’s primary mechanisms for managing corrective action activities at the Site since the RCRA Part B Corrective Action Permit expired in 1998.

2.3 Previous Investigations

From 1981 to the present, various investigations have been performed at the Site. Prior to 1987, the investigation activities were primarily related to groundwater monitoring associated with the RCRA surface impoundments. In 1987, Site-wide investigations began with the USEPA conducting a RCRA Facility Assessment (RFA), followed by RFI activities conducted by Beazer in 1990 and 1996. Additional investigations both within and beyond the property boundary depicted on Figure 2 — including groundwater monitoring and investigations of the Outfall 001 drainage ditch, tributary to Crawford Creek, Crawford Creek proper and associated floodplain areas — have been performed from 1996 to the present. Table 1 summarizes the scope and findings of the previous investigations and provides references to the various reports and submittals in which the scope and findings of the investigations were presented. All referenced reports and submittals have been provided to the WDNR, except the report summarizing the October 2006 to June 2007 supplemental groundwater investigations, which is currently in preparation.

In addition to the investigations summarized in Table 1, groundwater sampling has been performed at the Site since 1982 for detection and compliance monitoring (during both the operational and post-closure monitoring phases of the RCRA surface impoundments). From 1982 to 2002, groundwater monitoring was performed quarterly. In 2002, several modifications were made to the groundwater monitoring program based on the consistency of results since monitoring was initiated, including reducing the frequency of monitoring from quarterly to semiannually, modifying certain analytical parameters/methods and field sampling procedures, and reducing the number of wells subject to sampling. The modifications, which represent the scope of the current groundwater monitoring program, were documented in an April 19, 2002 letter from BBL to the WDNR (BBL, 2002b) and the *Groundwater Monitoring Sampling and Analysis Plan* (The RETEC Group, Inc. [RETEC], 2002). The WDNR indicated their approval of the Groundwater Sampling and Analysis Plan in a letter to Beazer dated October 29, 2002 (WDNR, 2002).

A brief data summary report is prepared following each groundwater monitoring event. The report is submitted to the WDNR within 60 days of completing the field work. In addition, an annual groundwater monitoring report is submitted to the WDNR by March 1 of each year. The annual report summarizes the scope, procedures and results of the semiannual groundwater monitoring performed during the previous year. As indicated in the *2006 RCRA Annual Groundwater Monitoring Report* (Field & Technical Services, LLC [FTS], 2007a), the extent of groundwater impacted with COPCs potentially released from the closed RCRA surface impoundments is not expanding and concentrations of COPCs are generally stable.

In addition to the RCRA groundwater monitoring program discussed above, Beazer conducted various supplemental groundwater investigation activities between July 2004 and April 2005 to provide data to support the natural attenuation-based approach for groundwater. The findings of those investigations, as reported in letters to the WDNR dated January 24, 2006 (BBL, 2006a) and April 27, 2006 (BBL, 2006d), indicate that groundwater concentration trends are generally stable or decreasing, and biodegradation and natural attenuation of COPCs in groundwater is occurring. As requested by the WDNR, additional groundwater investigations were conducted between October 2006 and June 2007 (report in preparation) to verify that the extent of groundwater impacts at the Site has been delineated. As further discussed in Sections 4.4.3 and 5.3.3, the supplemental groundwater investigation data collected between July 2004 and June 2007, along with Site-specific hydrogeological considerations, provide justification for the natural attenuation-based approach for groundwater.

3. Site Conceptual Model

3.1 Overview

The Site Conceptual Model (SCM) is a set of hypotheses about the processes that govern the presence, migration pathways and routes of potential exposure of COPCs in the on-property soil, Outfall 001 drainage ditch materials and groundwater. Those hypotheses are drawn from the results of various phases of the RFI and other investigations conducted since 1981. The overall goals of the environmental investigations carried out at the Site have been to gather appropriate information to develop the SCM and this Focused CMS Report. Factors affecting potential source areas, distribution of COPCs, potential migration pathways and potential exposure pathways are summarized below. This information serves as the basis for establishing CAOs (Section 4.2) and, in conjunction with the findings of the Post-Remediation HHRA (Section 4.3; Appendix A), for developing and evaluating potential corrective action alternatives (Sections 5 and 6, respectively).

Based on the findings of the RFI activities, an initial SCM was developed and presented in the Phase III RFI Report. That initial SCM is still representative of the current understanding of Site conditions, and serves as the basis for the SCM presented below. However, where appropriate, modifications have been made to reflect the findings of various investigations that have been performed since the Phase III RFI Report was submitted (Table 1). The SCM is illustrated graphically on Figure 3.

3.2 Geology and Hydrogeology

In general, glaciolacustrine deposits — consisting primarily of low-permeability clay — underlie the Site. The upper 15 feet of this clay contain fractures filled with silt and clay. Using the groundwater zone designations established during the RFI, the shallow (A) and intermediate (B) zones consist primarily of clay with little to no sand or gravel. In some Site areas, primarily in the vicinity of the former process area and tank farm, a thin layer (up to 2 feet) of fill material is present above the clay at the ground surface. Discontinuous deposits of fine- to coarse-grained sand and silt, at depths varying from 35 to 50 feet below ground surface (bgs), represent the C zone at the Site. The clay unit continues beneath the discontinuous sand and silt deposits to the top of the Precambrian Superior Sandstone, the uppermost bedrock at the Site. The Precambrian Superior Sandstone occurs beneath the Site at a depth of approximately 170 feet bgs, and represents the bedrock (D) zone at the Site. The bottom of the screened interval occurs at 13 to 15.5 feet bgs for wells in the A zone and at 30 to 35 feet bgs for wells in the B zone.

Groundwater exists beneath the Site in an unconfined state within the low-permeability clay (A and B zones). Groundwater is generally encountered at depths of 5 feet bgs or less. Because of the low hydraulic conductivities of the clay (see table below), this unit has been referred to as an aquitard. Groundwater may be retained, temporarily, in a perched form within the surficial fill layer, where present. In addition, groundwater is present in a confined state within the discontinuous silts and sands of the C zone and within the sandstone bedrock (D zone). Historically, groundwater elevation data consistently support a generally northward flow direction in all four stratigraphic zones. However, groundwater flow patterns in the A zone indicate localized variability to the overall northerly flow because of the combined effects of perched groundwater, low hydraulic conductivity of the clay and interactions with surface-water drainage ditches.

Hydraulic conductivity values were measured in 21 monitoring wells as part of the Phase II RFI activities and the associated data were presented in both the Phase II and Phase III RFI Reports. The following table summarizes the maximum, minimum and average hydraulic conductivity values measured for the A, B and C zones.

Zone	***# of Wells Tested***	***Hydraulic Conductivity (cm/s)***		
		Maximum	***Minimum***	***Average***
“A” Zone Wells	10	7.16×10^{-7}	8.93×10^{-8}	3.33×10^{-7}
“B” Zone Wells	4	1.27×10^{-5}	8.35×10^{-8}	3.26×10^{-6}
“C” Zone Wells	7	2.40×10^{-2}	4.54×10^{-5}	1.07×10^{-2}

Source: *Phase III RCRA Facility Investigation Report, Soil and Ground Water* (Fluor Daniel GTI, Inc., 1997b)

Because of the very low permeability of the clay (A and B zones) and the discontinuity of the sand lenses (C zone), groundwater containing COPCs has little potential for migrating significantly from source areas, either horizontally or vertically. Any COPCs that do enter the discontinuous sand lenses are not likely to, and have not been determined to, migrate past the edge of the sand lenses because of the surrounding low-permeability clay soils. Findings reported in the *2006 RCRA Annual Groundwater Monitoring Report* (FTS, 2007a) indicate that temporal trends of concentrations of

COPCs are stable or decreasing. Supplemental groundwater monitoring conducted between July 2004 and June 2007 also supports the conclusion of stable or decreasing groundwater concentration trends. Further, available data indicate that no COPCs have been detected in off-Site, downgradient residential wells.

3.3 Potential Source Areas and Distribution of COPCs

RFI-related activities included the investigation of nine solid waste management units (SWMUs) at the Site that were identified by the USEPA in the 1987 RFA. As a result of those investigations, seven potential source areas were identified. These areas are shown on Figure 2 and are described below.

Former Unlined Landfarm/Landfill (Area A)

The former unlined landfarm/landfill area, designated as “Area A” during the RFA, is located in the southeastern portion of the facility (Figure 2). Soils removed from a former loading dock area, which was dismantled during construction of the concrete drip pad, were historically placed in this area. Metal banding used to bind wood stacks and wooden “stickers” used to separate individual pieces of wood in stacks were also historically placed in this area, as were cutoffs (scraps of untreated wood from sizing operations).

Treatment Area (Area B)

The treatment area, designated as “Area B” during the RFA, is located near the northeastern corner of the facility (Figure 2). The treatment area includes former locations of work and product storage tanks, the former treatment building and a closed RCRA container storage facility.

Closed Surface Impoundments (Area C)

The closed surface impoundments area, designated as “Area C” during the RFA, is located west of the treatment area (Figure 2). The four former impoundments were constructed in 1977 to store wastewater, and were closed in 1982. Two replacement impoundments (RCRA surface impoundments), which are south of and overlie a portion of the former impoundments, were constructed in 1982 and closed in August 1988. The closed RCRA surface impoundments are not included as part of Area C.

Drip Track Area (Area F)

The drip track area, designated as “Area F” during the RFA, includes the railroad track adjacent to and south of the former treatment building location in the central portion of the facility (Figure 2). The drip tracks associated with the former wood treatment operations and the former adzing and boring mill comprise Area F. According to available information, the drip track and loading dock were historically unlined from the time the plant began operation in 1928 until approximately 1976 or 1977. At that time, the drip track adjacent to the treatment building was retrofitted with a concrete drip pad and sumps to collect wastewater. Prior to being closed as part of the facility decommissioning activities in 2006 and 2007, the drip pad was operated by KI as a RCRA-regulated hazardous waste management unit pursuant to Subpart W of 40 CFR 265.

Straw Bales Area (Area G)

The straw bales area, designated as “Area G” during the RFA, is located near the south end of the facility (Figure 2). Straw bales that had been used to absorb pentachlorophenol from a surface discharge were placed in this area from approximately 1978 to 1980.

Lead Track Landfill (Area H)

The lead track landfill area, designated as “Area H” during the RFA, is located south of the sprayfield, along the railroad track known as the lead track (Figure 2). Materials historically placed on the ground surface in this area include crossties, metal banding, wood stickers and process materials. The date that materials were first placed in this area is unknown, but it is believed to have been in use until the early 1980s. The area was bulldozed over after its use was discontinued.

Former Sprayfield (Area S)

The former sprayfield area, designated as “Area S,” is located west of the former treatment building and closed surface impoundments (Figure 2). This area was used as a spray irrigation field as part of the historical wastewater treatment process (until approximately 1988).

The seven areas identified above are all currently inactive with respect to the described historical uses. The buildings, tanks and other structures that were actively used as part of the wood-treating operations were decommissioned by KI between July 2006 and January 2007. Facility decommissioning activities were summarized in the *Decommissioning Report for the Treating Process, Equipment, and Buildings at Koppers Inc. Superior, WI Facility* (EPC Engineering & Testing, 2007), which was submitted to the WDNR by KI on May 1, 2007. As indicated above, prior to being closed in 2006, the concrete drip pad was operated and maintained by KI in accordance with RCRA 40 CFR Subpart W requirements. During construction of the concrete drip pad, visibly impacted soils were excavated and sent off Site for disposal. Sludges and visibly impacted soils were also removed for off-Site disposal as part of the closure of the non-RCRA surface impoundments. Closure of the RCRA surface impoundments was performed as a hybrid closure, where the sludges and soils were removed before construction of the RCRA cap. The straw bales have been removed from the straw bales area and this area is no longer used for disposal purposes of any kind. Likewise, the treatment area, former unlined landfarm/landfill, lead track landfill and former sprayfield are no longer being used.

The results of sampling and visual characterizations performed for the various phases of the RFI indicate that impacts to soil and groundwater are generally limited to the immediate vicinity of the various source areas. Groundwater within the clay aquitard beneath the following areas contains COPCs at shallow depths: former unlined landfarm/landfill area, treatment area, closed surface impoundments and straw bales area. Groundwater within the discontinuous sand lenses was found to be unaffected by COPCs, with the exception of isolated areas near the treating area and closed impoundments. Groundwater monitoring also indicates that groundwater impacted with COPCs has not migrated beyond the facility boundary. Residential wells in the area were identified and sampled, and results indicate that these wells are not impacted by COPCs. Furthermore, periodic sampling of bedrock monitoring wells installed at the Site in 1999 indicates nondetect to low levels of COPCs at the downgradient property boundary with generally decreasing concentration trends.

According to the Phase III RFI Report, dense nonaqueous phase liquid (DNAPL) was observed in three shallow (A-zone) monitoring wells at the Site. DNAPL thicknesses of up to 1.5 feet were observed in well W-27A (located in the treatment area) between 1990 and 1995, when the well was abandoned. Trace amounts of DNAPL have also been periodically detected in wells W-8A and W-30A (located near the closed surface impoundment area). DNAPL in these three wells is attributed to the well bore intersecting silty pockets of residual DNAPL near the surface, and resultant vertical migration and collection in the well. Based on available records, for at least the past 8 years DNAPL has not been observed in W-8A, W-30A, or at any of the other monitoring wells that are part of the current monitoring network. The potential for deeper migration of DNAPL is limited because of the unfractured nature of the deeper clay and because a lack of ongoing sources prevents DNAPL head accumulations that serve as a driving force for potential vertical migration. The high capillary pressure of the clay and nonwetting nature of the DNAPL inhibit its entry into or migration through the small aperture spaces of the clay matrix. As a result, residual DNAPL and staining are limited to larger aperture spaces (e.g., cracks, fissures) in the near-surface soils.

3.4 Potential Migration Pathways

Potential migration pathways include the limited movement of dissolved COPCs through groundwater and entrainment of suspended soils in surface water flowing over source areas. In those areas where COPCs were detected in unsaturated soils (former unlined landfarm/landfill, treatment area, closed surface impoundments, drip track area, straw bales area, former lead track landfill and former sprayfield), COPCs may be transported to surface-water drainages through erosion and subsequent transport of soil onto which constituents have adsorbed. Surface-water transport of dissolved constituents is not considered a primary migration mechanism, because the higher ring molecular structure of PAHs favors adsorption over dissolution. In addition, there is limited potential for leaching of COPCs from soil to groundwater due to the low permeability clay soils at the Site.

With respect to the presence of residual DNAPL in shallow soils, fractures in the clay matrix and higher permeability fill areas (where present) represent potential migration pathways. Although limited head (driving force) is likely to exist due to the shallow nature of these materials, groundwater gradients may induce DNAPL migration in instances where sufficient residual DNAPL exists to be potentially mobile. This is the likely migration pathway resulting in the visual observation of isolated seams of creosote-like product in fractures within shallow soils adjacent to the Outfall 001 drainage ditch. Specifically, residual DNAPL in adjacent source areas (i.e., the closed impoundments and treatment area) may have been induced to migrate with the groundwater gradient to this area. However, the extent to which this represents a significant migration pathway is limited by the low hydraulic gradients, limited residual quantity of product, lack of ongoing sources and extremely low migration rates through the clay soils.

3.5 Potential Exposure Pathways

There is no exposure point for COPCs in shallow groundwater; clays beneath the Site are relatively impermeable, the sand lenses are discontinuous and on-property groundwater is not used as a source of drinking water. Groundwater in the sandstone aquifer is used as a drinking-water source off Site; however, analytical data for bedrock wells at the Site do not indicate the potential presence of COPCs in off-Site bedrock groundwater at concentrations exceeding WDNR Enforcement Standards (ESs). In addition, samples collected from off-Site residential wells during the Phase III RFI, and more recently in 2001, 2003 and 2005, did not contain COPCs.[3]

In those areas where COPCs were detected in unsaturated soils (former unlined landfarm/landfill, treatment area, closed surface impoundments, drip track area, straw bales area, former lead track landfill and former sprayfield), COPCs may be contacted directly, or may be transported to surface-water drainage areas through erosion and subsequent transport of soil onto which constituents have adsorbed. A variety of potential exposure pathways to impacted on-property soils and potential receptors associated with Site use were evaluated in the Post-Remediation HHRA, which is further discussed in Section 4.3 and included as Appendix A.

The SCM and theoretical transport and exposure pathways are depicted on Figure 3. The depths to the water table and to bedrock, locations of various wells, and the primary groundwater migration pathway are shown in cross-sectional view. In addition, the interconnections among the elements contributing to theoretical transport and exposure pathways are presented and potential receptors are identified. The transport and exposure pathways for soil and surface water are further considered in the Post-Remediation HHRA (Section 4.3; Appendix A).

[3] Low-level concentrations (below applicable NR 140 standards) of certain PAHs were detected in one groundwater sample collected from a residential bedrock well north of the Site in April 2005. The well was resampled for confirmation in July 2005, and PAHs were not detected.

4. Corrective Action Goals and Objectives

4.1 Overview

This section identifies the various corrective action goals and objectives for those portions of the Site addressed in this Focused CMS Report. This includes a summary of the Site-specific CAOs that have been established for the various media, as well as a summary of the conclusions of the Post-Remediation HHRA that was performed to identify those areas of the Site requiring corrective action to achieve risk-based objectives. The CAOs and risk-based objectives serve as a basis for the development of potential corrective action alternatives (Section 5.3).

The areas targeted for corrective action, which were established based on the findings of the Post-Remediation HHRA, SCM and results of previous investigations, are described in Section 4.4. The basis for a natural attenuation-based approach for on-property groundwater is also summarized in Section 4.4.

4.2 Corrective Action Objectives

In accordance with NR 720 (soil cleanup standards) and NR 140 (groundwater standards) of the Wisconsin Administrative Code, CAOs have been established for the on-property portion of the Site. The generic CAOs for soils from NR 720 require remediation of impacted soils to restore the environment to the extent practicable, minimize harmful effects to lands and waters of the state, and protect public health and the environment. The generic CAOs for groundwater, listed at NR 140.24, address constituents exceeding Preventive Action Limits (PALs) or ES, and include the effects of exposure to groundwater on public health and the environment, and the probability that a PAL or ES will be exceeded at an appropriate point of standards application, as defined in NR 140.

The Site-specific objectives relate to the mitigation of potential human exposures to impacted media. Results of the RFI indicate that the primary potential for exposure to COPCs is by contact with surface soils. Because the clay beneath the Site acts as an aquitard, the likelihood of potential exposure to groundwater containing COPCs is low. The potential for exposure to materials within the Outfall 001 drainage ditch is similar to that of soils, but of lesser magnitude given the limited potential for human exposure to these materials relative to soils.

Considering the generic CAOs (established by NR 720 and NR 140.24) and the potential exposure routes at the Site, the following Site-specific CAOs have been established for on-property soils, the Outfall 001 drainage ditch, and on-property groundwater:

On-Property Soils

- mitigate direct contact by potential receptors to surface soil containing constituents of potential concern (COPCs) at concentrations that may affect human health

- minimize the potential for off-Site migration of COPCs through dissolved-phase transport (groundwater) or erosion (surface water)

Outfall 001 Drainage Ditch

- minimize the potential for direct contact with drainage ditch materials containing COPCs

- minimize the potential for downstream migration of COPCs via the Outfall 001 drainage ditch

On-Property Groundwater

- minimize the potential for off-property migration of impacted groundwater at concentrations exceeding an appropriate Prevention Action Limit (PAL) or Enforcement Standard (ES)

The second CAO listed above for the Outfall 001 drainage ditch is intended to address the presence of creosote-like material in isolated soil fractures adjacent to the ditch, as observed during 2003 and 2005 field investigations. It should be noted, however, that potential impacts to the ditch resulting from the presence of this material in adjacent soils has not been confirmed by Site investigations. Further, previous monitoring performed by KI at Outfall 001 has not indicated the downstream transport of constituents above Wisconsin Pollutant Discharge Elimination System (WPDES) permitted levels. Nonetheless, as a proactive measure, Beazer has elected to identify and evaluate potential corrective action alternatives to mitigate the potential future occurrence of such migration. This is based on the potential for future corrective action activities in the off-property portion of the Site (i.e., tributary to Crawford Creek, Crawford Creek and associated floodplain areas; to be evaluated in a separate CMS report pending further evaluation of these areas), and the desire to minimize the potential for on-property areas to impact downstream areas in the future.

4.3 Risk-Based Objectives: Summary of Post-Remediation HHRA

A Post-Remediation HHRA was conducted to identify areas of the Site that could be targeted for corrective action such that Site-specific CAOs for on-property soils would be met and to confirm that, if implemented, any proposed corrective action would result in acceptable levels of potential carcinogenic and noncarcinogenic health risk. The Post-Remediation HHRA addresses the Site-specific CAOs for on-property soils only. CAOs for the Outfall 001 drainage ditch and on-property groundwater are described above and addressed within other sections of this Focused CMS Report. The Post-Remediation HHRA is summarized below; the entire report is provided in Appendix A of this Focused CMS Report.

To evaluate CAOs for on-property soils, the Post-Remediation HHRA consisted of the following four steps:

- hazard identification — identify COPCs

- toxicity assessment — determine the relationship between the magnitude of exposure to each constituent (dose) and the occurrence of specific health effects for a potential receptor (response); both potentially noncarcinogenic and potentially carcinogenic effects were evaluated

- exposure assessment – identify potential receptors and exposure pathways, and determine the magnitude and frequency of receptors' potential exposure to COPCs

- risk characterization – derive quantitative estimates of potential human health direct-contact risk from potential exposure to COPCs in surface soils and human health direct-contact risk from potential exposure to COPCs in surface water (in the Tributary to Crawford Creek and Crawford Creek proper) due to erosion and runoff of surface soils following corrective action at the targeted soil areas

Potential health risks were calculated first to identify areas within the on-property portion of the Site subject to corrective action and then to estimate potential risk under post-implementation Site conditions. The following receptors were evaluated:

- KI Site Worker
- Trespasser
- Construction Worker
- Utility Worker

All potential receptors were assumed to contact COPCs in soil at the Site via incidental ingestion, dermal contact, inhalation of volatiles migrating from soil to ambient air and inhalation of soil-derived dust in ambient air.

Possible corrective action scenarios were evaluated in an iterative manner, assuming that exposure to COPCs in surficial soils at various soil sample locations was eliminated. Sample locations were iteratively removed from the dataset (as if exposure to surface soil at that sample location was eliminated to a depth of 1 foot bgs) to determine the extent of soils requiring corrective action to meet the following WDNR-specified carcinogenic and noncarcinogenic risk limits for receptors potentially exposed to surface soil:

- Site-wide and area-specific[4] total potential risk less than or equal to 1×10^{-5}
- Site-wide and area-specific potential risk associated with benzo(a)pyrene toxic equivalents (BaP-TE) less than or equal to 7×10^{-6}
- Site-wide and area-specific potential risk associated with pentachlorophenol less than or equal to 1×10^{-6}
- Site-wide and area-specific potential risk associated with PCDDs/PCDFs (as represented by the 2,3,7,8-tetrachlorodibeno-p-dioxin toxicity equivalent [TCDD-TEQ]) less than or equal to 1×10^{-5}
- Site-wide and area-specific potential hazard index less than or equal to 1

[4] Potential residual risks (i.e., estimated potential risks remaining after corrective action activities are completed) were calculated for the entire on-property portion of the Site and also on an SWMU-specific basis.

This iterative, post-remediation risk assessment approach is described in further detail in the Post-Remediation HHRA (Appendix A).

As indicated in the Post-Remediation HHRA (Appendix A), elimination of exposure to a total of 38 soil samples (Table 11 in Appendix A; Figure 4), all to a depth of 1 foot bgs, results in potential risk estimates that meet the WDNR-specified risk limits listed above. Therefore, performing corrective action to address these soil sample locations would achieve the Site-specific CAOs for on-property soils. The soil samples requiring corrective action to achieve the risk-based objectives are illustrated on Figure 4 of this Focused CMS Report and Figure 1 of the Post-Remediation HHRA report (Appendix A).

4.4 Targeted Corrective Action Areas

As previously discussed, this Focused CMS Report addresses the on-property soils, the Outfall 001 drainage ditch and on-property groundwater. These areas have been targeted considering the SCM, findings of the Post-Remediation HHRA and results of previous investigations. The specific limits associated with each area/medium are described in the following subsections.

4.4.1 On-Property Soils

The extent of on-property soils targeted for corrective action activities was determined based on the conclusions of the Post-Remediation HHRA (Section 4.3; Appendix A). Specifically, to achieve risk-based goals for the on-property portion of the Site, the Post-Remediation HHRA concluded that corrective action would be required for a total of 38 soil sample locations (Table 11 in Appendix A; Figure 4). Based on discussions during a May 24, 2006 meeting, the WDNR indicated that corrective actions must be performed to “the next ‘clean’ sample point,” or verification sampling will be required during remedy implementation so that soils remaining outside of the corrective action areas are at or below the acceptable risk-based levels.

Beazer conducted additional soil sampling in 2006 so that maximum corrective action areas could be determined in advance by connecting “clean” sample points surrounding the soil samples determined to require corrective action based on the Post-Remediation HHRA. Where appropriate, Site features were also used to establish corrective action limits in certain areas. Using this approach, seven discrete areas have been identified for corrective action for on-property soils (Figure 4).[5] These areas comprise a cumulative area of approximately 8.7 acres. Because the Post-Remediation HHRA indicates that hypothetical exposure to surface soils is the scenario that drives the risk-based goals, only the surface soils (i.e., 0- to 1-foot bgs) within this area are targeted for corrective action. Based on these limits, the approximate volume of soils targeted for corrective action activities is estimated to be approximately 14,100 in-situ cubic yards (cy).

4.4.2 Outfall 001 Drainage Ditch

The drainage ditch along which Outfall 001 is located originates on the east side of County Road A. The ditch flows through a culvert beneath County Road A and through another culvert on the KI Facility east of the treatment area. Following a short reach of open channel east of the treatment area, the ditch flows through a culvert beneath the treatment area and drip track, and re-emerges into an open channel to the west of the treatment area. From this point, the ditch flows west through an open channel toward Outfall 001, passing through two additional culverts beneath active railroad tracks. At Outfall 001, the ditch turns toward the northwest, crosses the facility property line and enters a series of culverts beneath railroad tracks and Hammond Avenue north of the facility. The course of the ditch is shown on Figure 2.

The portion of the Outfall 001 drainage ditch considered within this Focused CMS Report extends from the outlet of the first culvert west of the treatment area downstream to the point at which the ditch enters a culvert beneath the railroad tracks near the northwest corner of the property (approximately 95 feet downstream of Outfall 001). This area, shown on Figure 4, includes approximately 620 linear feet of the ditch and generally corresponds to the areas where impacted materials have been observed during previous investigations. The upstream limit of this reach was established based on the fact that the short stretches of on-Site, open channel upstream of this culvert are associated with the targeted soil area and there are no known or suspected source areas to open channels upstream of that point (i.e., a culvert minimizes the potential for impacts to the portion of the ditch traversing the treatment area and areas further upgradient are in an unused portion of the facility and undeveloped areas east of

[5] In selecting sample locations to define the corrective action boundaries, “boundary samples” were chosen if they had surficial soil analytical data below the risk-based delineation objective for the COPC driving the risk in that given area.

County Road A). The downstream limit was established as a practical demarcation between the on-property portion of the ditch (addressed by this Focused CMS Report) and the downstream tributary to Crawford Creek (to be separately addressed).

4.4.3 Groundwater

The corrective action approach for groundwater is natural attenuation of COPCs. Consistent with WDNR regulations and guidance[6], this approach uses extensive characterization and documentation to both confirm that natural attenuation is occurring and to provide a basis for WDNR's approval of a natural attenuation approach. As further discussed in Section 5.3.3, Beazer has conducted several investigations since 2004 that confirm that concentrations of COPCs in groundwater are stable or decreasing, and that natural attenuation of COPCs is occurring. The natural attenuation-based approach for groundwater is appropriate considering the following key points:

- hydraulic conductivity at the Site is low
- potential for migration of COPCs in groundwater is limited
- there is currently no exposure pathway for groundwater and future exposure is not expected to occur
- impacted groundwater at the Site is not used or expected to be used as a potable source[7]
- the extent of impacted groundwater at the Site is limited and is not migrating beyond the facility boundary at levels above ESs

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[6] Applicable regulations and guidance include: NR 140.24(4) Table 5(12); NR 140.26(2) Table 6(8); NR 726.05(2)(b)2,3; *Guidance of Natural Attenuation for Petroleum Releases* (PUB-RR-614; WDNR, 2003) and *Guidance on Case Closure and the Requirements for Institutional Controls and VPLE Environmental Insurance* (PUB-RR-606; WDNR, 2005b).

[7] Groundwater drawn from an unimpacted bedrock well is used for nonpotable purposes (e.g., hand washing) at the KI Facility. Periodic sampling of this well has been conducted to verify that COPCs are not present above the WDNR's PALs or ESs.

- the nature and extent of impacted groundwater at the Site is defined
- no COPCs have been detected in off-Site, downgradient residential well samples (with one exception and results of one confirmation sample were nondetect)
- there is no active source of COPCs to groundwater
- concentrations of COPCs in groundwater are stable or decreasing (BBL, 2006a and 2006d)
- groundwater sample data for electron acceptors, metabolic by-products, microbial indicators and other natural attenuation indicator parameters support the conclusion that COPC biodegradation and natural attenuation are occurring (BBL, 2006a and 2006d)

Results of previous investigations have shown that shallow groundwater is impacted by COPCs in the immediate vicinity of the former unlined landfill/landfarm, treatment area, closed surface impoundments and straw bales area. Supplemental groundwater investigations conducted between October 2006 and June 2007 further delineate groundwater impacts at the Site and confirm the occurrence of natural attenuation of COPCs (as indicated in Section 2.3, a report summarizing those investigations is currently being prepared). In general, these investigations show that the areas of impacted groundwater are localized and limited in horizontal and vertical extent. However, the natural attenuation approach for groundwater is applicable to the entire on-property portion of the Site.

5. Identification of Corrective Action Alternatives

5.1 General

As described in Section 1.1, this Focused CMS Report is termed “focused” in that it does not extensively evaluate a broad range of potentially applicable corrective action technologies. Rather, it focuses on technologies and alternatives that are known to have been used successfully to address similar conditions at other wood-treating sites. This reflects Beazer’s 20-plus years of experience at evaluating and implementing corrective action alternatives at numerous sites impacted by wood-treating operations across the country. Many potential alternatives have previously been discussed, reviewed and/or attempted at some scale at other wood-treating sites in the past, and, based on that experience, have not been considered in this Focused CMS Report. This approach results in a focused set of potential corrective action alternatives for soils and for the portion of the Outfall 001 drainage ditch addressed herein (see Section 4.4).

With respect to groundwater, this Focused CMS Report is “focused” in that it does not identify and evaluate multiple alternatives. Instead, it supports the use of a natural attenuation-based approach. This approach to limiting the scope of corrective action options considered was presented to and discussed with the WDNR at meetings in 1996 and 2000, and was specifically described in the Phase III RFI Report. More recently, it was discussed with and agreed upon by the WDNR during November 21, 2003 (BBL, 2003c) and April 11, 2007 meetings between Beazer and WDNR.

With respect to on-property soils and the Outfall 001 drainage ditch, the development of potential corrective action alternatives involved a multistep process. First, considering previous discussions with the WDNR, Beazer’s experience at similar sites and the focused nature of this evaluation, a list of potentially applicable technologies was identified and screened. Retained technologies were then assembled into corrective action alternatives considered potentially capable of achieving the established CAOs. Separate corrective action alternatives were developed for the on-property soils and the Outfall 001 drainage ditch. The technology screening process and assemblage of corrective action alternatives is further discussed in Sections 5.2 and 5.3.

For groundwater, a natural attenuation-based approach was previously identified and supported in the Phase III RFI. Because monitoring performed since that time has not indicated that groundwater conditions or migration potential of COPCs are different than previously characterized (and supplemental groundwater sampling data have been collected to demonstrate that COPC trends are generally stable or decreasing, and that biodegradation and natural attenuation of COPCs in groundwater is occurring [BBL, 2006a, 2006d]), the natural attenuation-based approach remains valid and is reiterated below. Based on the prior and more recent justification provided to support the natural attenuation-based approach, other potential approaches for groundwater are not identified or evaluated within this Focused CMS Report.

Two additional items related to the range of potential corrective action alternatives are also discussed in this section: institutional controls (Section 5.4) and the proposed establishment of a Corrective Action Management Unit (CAMU; Section 5.5). Based on the assumptions applied in the Post-Remediation HHRA (Section 4.3; Appendix A), namely the fact that the on-property portion of the Site will remain in industrial use, institutional controls will be necessary so that future property uses are consistent with this assumption. Such controls will be required regardless of the corrective action alternatives implemented at the Site. In anticipation of the potential need for cost-effective management of materials excavated during corrective action activities, a proposal to establish a CAMU at the Site was previously submitted to and approved by the WDNR.[8] The CAMU could be used for on-Site consolidation and long-term management of materials excavated from various areas of the Site, and is therefore applicable to all alternatives that involve excavation of soils and/or ditch materials. Because the baseline institutional controls and the CAMU relate to several or all of the various alternatives presented and evaluated herein, they are discussed separately below.

5.2 Initial Screening of Corrective Action Technologies

In accordance with NR 722.07, an initial screening was performed to identify technologies potentially applicable for the targeted on-property soils and Outfall 001 drainage ditch area, and upon which corrective action alternatives may be developed. The focused lists of technologies that were considered for the targeted soils and the Outfall 001 drainage ditch are listed in Tables 2 and 3, respectively. These focused lists were developed considering various factors, including:

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[8] *Request for Modification of the Closure and Long-Term Care Plan Approval and Corrective Action Management Unit (CAMU) Demonstration* (BBL, 2000a).

- Beazer's 20-plus years of experience at evaluating and implementing corrective action alternatives at numerous sites impacted by wood-treating operations across the country

- Site-specific considerations such as the shallow depth to groundwater, geology, COPCs, location and volume of materials targeted for corrective action, and nature of ongoing facility operations

- focus on readily implementable and proven corrective action technologies

- expected continued use of the property as an industrial facility

- previous discussions and coordination with the WDNR

The focused lists of potentially applicable technologies were then screened on the basis of Site-specific feasibility, including applicability to the types of constituents present, target areas/media and Site characteristics. As appropriate, the degree of effectiveness and relative cost-effectiveness were also considered in the screening process to further differentiate among the various technologies.

Results of the initial screening are summarized in Tables 2 and 3. Because the list was focused to begin with (as previously discussed), only a few options were screened from further consideration. In particular, treatment technologies (both in-situ and ex-situ) were eliminated from further evaluation. While several treatment technologies exist that are potentially applicable to the types of constituents present at the Site, Beazer's experience at evaluating and/or applying such technologies at other similar sites suggests they are not applicable to this Site based on a variety of considerations. These technologies are rarely as effective at full scale as they are in laboratory- or bench-scale testing, extensive bench- or pilot-scale tests are typically required, and the costs are typically high. From a Site-specific perspective, the nature of the clay matrix and climatic conditions would also hinder the effectiveness of certain technologies (e.g., bioremediation), while the shallow groundwater table and other factors preclude other technologies (e.g., thermal treatment, chemical extraction). In contrast, the retained options have been implemented successfully at a wide range of other sites across the country, have proven to be both technically effective and a cost-effective means of addressing similar constituents in similar media, and are appropriate given the limited and specific areas addressed in this Focused CMS Report.

The technologies and process options retained for further consideration for the targeted areas of on-property soils and the Outfall 001 drainage ditch are listed below.

On-Property Soils	***Outfall 001 Drainage Ditch***
Institutional controls	Institutional controls
Monitoring (field observation)	Monitoring (field observation)
Surface cover	Engineered cap
Excavation	Culverting
Placement of excavated soils in on-Site CAMU	Channel relocation
Off-Site disposal of excavated soils	Excavation
	Nonaqueous phase liquid (NAPL) collection
	Placement of excavated materials in on-Site CAMU
	Off-Site disposal of excavated materials

The basis for retaining each of these technologies and process options is summarized in Tables 2 and 3.

5.3 Corrective Action Alternatives

The retained technologies and process options were assembled into various alternatives potentially capable of achieving the established Site-specific CAOs (Section 4.2). Potential alternatives addressing the targeted soils and Outfall 001 drainage ditch are described below. The proposed approach for on-property groundwater is described and cost estimates associated with each alternative are also presented. These alternatives are evaluated in detail in Section 6 relative to the criteria described in NR 722.07(4).

5.3.1 On-Property Soils

To address the presence of COPCs in soils in the on-property areas targeted for corrective action, three alternatives have been developed. The scope and estimated cost associated with each alternative are summarized in Sections 5.3.1.1, 5.3.1.2 and 5.3.1.3.

5.3.1.1 Alternative S-1 — Surface Cover

This alternative generally includes placing a surface cover over the targeted soil areas to eliminate the potential for exposure to existing surface soils exceeding risk-based goals. Key components of this alternative include the following:

- install a surface cover over the targeted soil areas
- conduct periodic post-construction inspections and maintenance
- establish baseline institutional controls (Section 5.4), plus measures to provide for the continued integrity of the surface cover

Under this alternative, surface covers would be installed over each of the seven areas indicated on Figure 4. These areas were identified based on the Post-Remediation HHRA (Section 4.3; Appendix A), and represent a combined area of approximately 8.7 acres. The surface cover would isolate the impacted surface soils from direct contact by potential receptors and minimize potential off-Site migration of COPCs from the covered area. The surface cover would be constructed of suitable materials and of suitable thickness (i.e., 1 foot) to isolate the subject soils from exposure by current or potential future Site workers (i.e., those potential receptors that, according to the Post-Remediation HHRA, drive the risk-based objectives).

Because portions of the areas targeted for corrective action are in and around active operations, regrading may be necessary in certain areas prior to installing the surface cover. Specifically, regrading may be necessary such that, once the surface cover materials are placed, appropriate access to building doors, railroad tracks, etc. is maintained and suitable working surfaces continue to exist. Clearing and grubbing of vegetation may also be required in certain areas.

Following clearing, grubbing and regrading, a layer of geotextile would be installed across the targeted areas to separate impacted materials from cover materials.

Surface cover materials would then be installed on top of the geotextile and appropriately graded and compacted. While the specific type(s) of surface cover materials would be determined during detailed design considering the anticipated uses within the cover area (e.g., vehicle transport, material staging, grass cover, wetland restoration), possible materials include soil fill, gravel, asphalt, topsoil, and/or hydric soil. For example, active roadways may be covered with gravel to allow for operation of vehicles on top of the cover materials, while unused open spaces may be covered with soil fill, and seeded to re-establish a vegetative cover.

Based on the findings of wetland delineation activities conducted in 2002 and 2005, the proposed surface cover area (Figure 4) encompasses approximately 3 acres of wetlands. Accordingly, this alternative also includes activities that may be required to mitigate the “filling” of, or other impacts to, these wetland areas during construction of the surface cover. Such mitigation activities may include wetland creation, enhancement, restoration and/or preservation. The exact wetland mitigation activities would be determined during the permitting process in coordination with the WDNR and United States Army Corps of Engineers (USACOE).

Post-installation monitoring and maintenance of the surface cover would be performed to verify that an appropriate thickness and integrity of cover material remains in place. For example, inspections would be performed to verify that a minimum cover thickness is maintained and to verify that erosion or degradation of the covered areas has not occurred. As necessary, maintenance activities would be performed based on these inspections. This may include placement of supplemental fill in areas of soil and/or gravel cover, or reseeding vegetated areas.

Alternative-specific institutional controls would be a necessary component of this approach. In addition to the baseline institutional control that would limit future use of the on-property portion of the Site to industrial purposes (Section 5.4), the following controls would be necessary to provide long-term protection of human health and minimize the potential for off-Site migration of COPCs:

- requirement to maintain the surface cover at the designed thickness
- requirement to maintain vegetated portions of the surface cover
- prohibit excavation or other types of surface disturbance in the targeted area without an appropriate health and safety plan, and soil management plan

Institutional controls will be established as part of the Site closure process.

The estimated cost associated with this alternative is $1,696,000. In accordance with NR 722.07(4)(b), this includes estimated capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs associated with this alternative. It does not include the cost for establishing the baseline institutional control, which is an additional cost applicable to all alternatives regardless of the selected approach. The alternative-specific cost is summarized in Table 4 and a detailed estimate is provided in Appendix B, Table B-1.

5.3.1.2 Alternative S-2 — Excavation with Placement in an On-Site CAMU

This alternative includes excavation of the targeted soils, placement of those materials in a containment cell to be established within an on-Site CAMU and restoration of the excavation areas. The primary components of this approach are as follows:

- construct a CAMU containment cell in a designated area of the Site (as described in Section 5.5)
- excavate impacted soils in the targeted areas
- consolidate excavated materials within a CAMU containment cell
- backfill and restore the excavation areas to re-establish original surface grades and cover types (including re-establishment of existing drainage ditches located within the soil removal areas)
- conduct periodic post-construction inspections and maintenance
- establish baseline institutional controls (Section 5.4), plus additional alternative-specific controls (related to the CAMU) to provide for the continued integrity and effectiveness of the alternative

Under this alternative, soils would be excavated to a depth of 1 foot bgs within each of the areas indicated on Figure 4. These areas were identified based on the Post-Remediation HHRA (Section 4.3; Appendix A) and represent a combined area of approximately 8.7 acres. This represents a total removal volume of approximately 14,100 in-situ cy. Excavation would provide permanent removal of soil at the sample locations that cause risk-based goals to be exceeded under baseline conditions (i.e., prior to remediation), prevent direct contact by potential receptors and minimize potential off-Site migration of COPCs from the targeted areas.

Following clearing and grubbing (in certain areas), excavation would be performed using standard earthmoving equipment (e.g., excavators, loaders). In certain areas (e.g., around buildings, railroad tracks), manual soil removal may be required. Because the soils subject to removal are shallow surface soils located above the water table, it is anticipated that dewatering, stabilization, or solidification of the excavated materials would not be necessary prior to consolidation in the on-Site CAMU containment cell. Once the CAMU containment cell is constructed and ready to accept materials, the excavated soils would be transported via an on-Site route to the CAMU area and consolidated within the containment cell. After all excavated soils have been placed and consolidated, the containment cell would be closed, managed, inspected and maintained as described in Section 5.5.

Prior to backfilling the excavation areas, one layer of geotextile would be placed to segregate the fill materials from the underlying soils. The excavated area would then be backfilled with clean fill to re-establish the original grades within the area. While the specific type(s) of backfill materials would be determined during detailed design considering the anticipated uses within the excavation areas (e.g., vehicle transport, material staging, grass cover, wetland restoration), possible materials include soil fill, gravel, asphalt, topsoil, and/or hydric soil. For example, active roadways may be covered with gravel to allow for operation of vehicles on top of the cover materials, while unused open spaces may be covered with soil fill, and seeded to re-establish a vegetative cover.

Based on the findings of wetland delineation activities conducted in 2002 and 2005, the proposed excavation areas (Figure 4) encompass approximately 3 acres of wetlands. Within these areas, wetlands may be restored by backfilling the excavations with hydric soils and re-establishing wetland vegetation. As such, no additional wetland mitigation is anticipated to be required as part of this alternative, although a final determination regarding the need for wetland mitigation would be made during the permitting process in coordination with the WDNR and the USACOE.

Post-implementation monitoring of the excavated/backfilled areas would be performed in the short-term to verify that the backfilled and restored areas are performing adequately, excessive settlement/erosion does not occur and vegetation becomes re-established in seeded areas. While additional fill would be placed in areas of settlement/erosion, routine supplements to the fill materials are not anticipated because substantial long-term erosion to the fill materials is not anticipated to occur. Specifically, because the fill material would re-establish existing grade, and because existing facility activities do not and are not expected to include substantial disruption of surface soils, it is anticipated that the backfill materials would remain in place without routine maintenance.

In addition to baseline institutional controls (Section 5.4), CAMU-specific restrictions would also be required. The nature of such restrictions is further discussed in Section 5.5.

The estimated cost associated with this alternative is $4,830,000. In accordance with NR 722.07(4)(b), this includes estimated capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs associated with this alternative. It also includes estimated costs associated with the construction, operation and maintenance of a CAMU ($2,213,000). It does not include the cost for establishing baseline institutional controls, which is an additional cost applicable among all alternatives regardless of the selected approach. The alternative-specific cost is summarized in Table 4 and a detailed summary of the estimated cost is provided in Appendix B, Table B-2. Table B-8 of Appendix B summarizes costs associated with construction, operation and maintenance of the CAMU containment cell.

5.3.1.3 Alternative S-3 — Excavation with Disposal at an Off-Site Commercial Facility

This alternative is similar to Alternative S-2, except that the excavated soils would be disposed of at an appropriately permitted off-Site land disposal facility rather than placed in an on-Site CAMU. This approach includes the following key components:

- excavate impacted soils in the targeted areas
- transport excavated materials to an appropriately permitted off-Site commercial land disposal facility
- backfill and restore the excavation areas to re-establish original surface grades and cover types (including re-establishment of existing drainage ditches located within the soil removal areas)
- conduct periodic post-construction inspections and maintenance

- establish baseline institutional controls as described in Section 5.4

Under this alternative, soils would be excavated to a depth of 1 foot bgs within each of the areas indicated on Figure 4. These areas were identified based on the Post-Remediation HHRA (Section 4.3; Appendix A) and represent a combined area of approximately 8.7 acres. This represents a total removal volume of approximately 14,100 in-situ cy. Excavation would provide permanent removal of soil at the sample locations that cause risk-based goals to be exceeded under baseline conditions (i.e., prior to remediation), prevent direct contact by potential receptors and minimize potential off-Site migration of COPCs from the targeted areas.

Following clearing and grubbing (in certain areas), excavation would be performed using standard earthmoving equipment (e.g., excavators, loaders). In certain areas (e.g., around buildings, railroad tracks), manual soil removal may be required. Because the soils subject to removal are shallow surface soils located above the water table, it is anticipated that dewatering, stabilization, or solidification of the excavated materials would not be necessary prior to off-Site transport. Accordingly, excavated materials would be loaded directly into vehicles or containers to be used for off-Site transport of the materials to the commercial disposal facility. All vehicles or containers used for off-Site transport would be appropriately manifested and labeled in accordance with Department of Transportation and RCRA requirements.

Materials subject to excavation and off-Site disposal under this alternative may contain RCRA-listed F032 and F034 wastes. F032 waste is described as wastewater, process residuals, preservative drippage and spent formulations from wood-preserving processes generated at plants that currently use, or have previously used chlorophenolic formulations. F034 waste is described as wastewater, process residuals, preservative drippage and spent formulations from wood-preserving processes at plants that use creosote formulations. Due to the potential presence of such materials, land disposal of such materials in the United States would be subject to the RCRA Land Disposal Restrictions (LDRs; 40 CFR 268)[9].

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[9] It is possible that the materials could be disposed off Site as “CAMU-eligible waste.” However, it is uncertain whether the requisite regulatory and facility approvals could be obtained for off-Site disposal as “CAMU-eligible waste” or that any significant cost reduction would result, so this approach is not evaluated herein.

Because the materials targeted for excavation are soils, the LDRs would require that these materials either be treated to meet the waste-code-specific treatment standards of 40 CFR 268.40 or the alternative soil treatment standards of 40 CFR 268.49. The alternative soil treatment standards would require treatment for all constituents listed at 40 CFR 268.48 to achieve either a 90 percent reduction in constituent concentrations or a maximum concentration no greater than 10 times the universal treatment standards specified in 40 CFR 268.48 (whichever is greater). In either case, it is anticipated that treatment would be required prior to land disposal in a Subtitle C hazardous waste disposal facility. Based on the required levels of treatment and variety of organic constituents potentially present, the likely means of treatment would be soil incineration. In addition, because the F032 and F034 treatment standards include inorganic constituents, it is also possible that the incinerated soils may require further treatment (e.g., stabilization) to achieve inorganic treatment standards prior to land disposal.

To avoid the potentially prohibitive costs associated with off-Site treatment and disposal in accordance with RCRA LDRs, Beazer anticipates that off-Site land disposal, if selected, would occur at a commercial disposal facility in Canada. Specifically, for this type of material, Beazer typically uses the Clean Harbors “Sarnia” Facility located in Corunna, Ontario, Canada. This provides for a more cost-effective alternative for off-Site disposal of excavated soils.

Prior to backfilling the excavation areas, one layer of geotextile would be placed to segregate the fill materials from the underlying soils. The excavated area would then be backfilled with clean fill to re-establish the original grades within the area. While the specific type(s) of backfill materials would be determined during detailed design considering the anticipated uses within the excavation areas (e.g., vehicle transport, material staging, grass cover, wetland restoration), possible materials include soil fill, gravel, asphalt, topsoil, and/or hydric soil. For example, active roadways may be covered with gravel to allow for operation of vehicles on top of the cover materials, while unused open spaces may be covered with soil fill, and seeded to re-establish a vegetative cover.

Based on the findings of wetland delineation activities conducted in 2002 and 2005, the proposed excavation areas (Figure 4) encompass approximately 3 acres of wetlands. Within these areas, wetlands may be restored by backfilling the excavations with hydric soils and re-establishing wetland vegetation. As such, no additional wetland mitigation is anticipated to be required as part of this alternative, although a final determination regarding the need for wetland mitigation would be made during the permitting process in coordination with the WDNR and the USACOE.

Post-implementation monitoring of the excavated/backfilled area under this alternative would be the same as that described for Alternative S-2. As described in Section 5.3.1.2, this would generally include short-term post-construction inspections to verify that the backfilled and restored areas are performing adequately, excessive settlement/erosion does not occur and vegetation becomes re-established in seeded areas.

The estimated cost associated with this alternative is $13,150,000. In accordance with NR 722.07(4)(b), this includes estimated capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs associated with this alternative. It does not include the cost for establishing baseline institutional controls, which is an additional cost applicable among all alternatives regardless of the selected approach. The alternative-specific cost is summarized in Table 4 and a detailed summary of the estimated cost is provided in Appendix B, Table B-3.

5.3.2 Outfall 001 Drainage Ditch

As summarized in an October 2, 2003 letter report to the WDNR (BBL, 2003b), creosote-like product was observed in isolated seams in the soil matrix within and adjacent to the Outfall 001 drainage ditch. The potential for impacts to the ditch resulting from the presence of these materials has not been documented and monitoring performed by KI has not indicated that the creosote-like product is migrating downstream. Nevertheless, Beazer anticipates that proactive measures will be taken to mitigate the potential for current or future discharges from subsurface soils to the Outfall 001 drainage ditch. In lieu of further evaluation of the potential for such discharges, Beazer has elected to identify and evaluate potential corrective action alternatives to mitigate direct contact with, and potential migration of, COPCs in drainage ditch materials. This is based on the potential for future corrective action activities in the off-property portion of the Site (i.e., tributary to Crawford Creek, Crawford Creek and associated floodplain areas; to be evaluated in a separate CMS report pending further evaluation of these areas), and the desire to minimize the potential for on-property areas to impact downstream areas in the future. To address the presence of COPCs within and adjacent to the Outfall 001 drainage ditch, three alternatives have been developed. The scope of each alternative is described in Sections 5.3.2.1, 5.3.2.2 and 5.3.2.3.

5.3.2.1 Alternative D-1 — Culverting the Existing Ditch

Alternative D-1 involves installing a culvert pipe to convey surface-water flow through the Outfall 001 drainage ditch. The culvert pipe would eliminate direct contact between the surface water and adjacent bank soils. It would also eliminate the potential for erosion of bank soils under higher flow conditions in the channel. As a proactive measure to address the potential presence of potentially mobile DNAPL, this alternative also includes a permeable trench and sumps beneath portions of the culvert to monitor for DNAPL accumulation and, if necessary, provide a means for DNAPL removal. The components of this alternative are as follows:

- install a high-permeability zone (e.g., crushed stone) with periodic sumps and monitoring/collection points along the bottom of the existing ditch
- install a culvert along the bottom of the Outfall 001 drainage ditch
- conduct periodic post-construction inspections to verify the continued effectiveness of the remedy
- establish baseline institutional controls as described in Section 5.4

For this Focused CMS Report, culverting was selected as the representative in-situ containment/isolation technology based on the technology screening summarized in Table 3. However, an engineered cap was also retained as a potentially applicable technology that could accomplish the same objective as the culvert. While the culverting approach is specifically evaluated here, the use of an engineered cap in lieu of a culvert may be further evaluated during detailed design. The culvert-based approach is conceptually illustrated on Figure 5.

Under this alternative, a shallow (e.g., 2 feet or less) permeable trench would be installed along the bottom of the targeted portion of the Outfall 001 drainage ditch. At approximately three locations along the trench, slightly wider and deeper excavation would be performed to create DNAPL collection sumps. Following excavation, the trench and sumps would be backfilled with a permeable medium (e.g., crushed stone). Each of the three sumps would be separated from downstream sections by installing anti-seep collars along the culvert pipe. A riser pipe would be installed in each sump to provide a means for monitoring and removing the potential accumulation of DNAPL that may enter the permeable medium and flow downgradient into the collection sumps. The purpose of this permeable zone, which is illustrated conceptually on Figure

5, is to provide a means to collect any potentially mobile DNAPL that may be present in the vicinity of the ditch, and thereby minimize the potential for adverse migration under the modified hydraulic conditions resulting from the culvert installation.

Following installation of the permeable medium, approximately 620 linear feet of culvert pipe would be installed along the ditch (i.e., on top of the permeable medium). This pipe would be connected to the existing culvert at the point where the ditch passes beneath the railroad track west of the former treatment building (Figure 5). To minimize the potential for development of a preferential migration pathway along the culvert pipe, migration control barriers (i.e., anti-seep collars, bentonite walls and/or other measures) would be installed at locations corresponding to the sumps installed in the permeable medium beneath the culvert pipe.

Catch basins would be installed at the points where existing tributaries (i.e., adjacent ditches) enter the Outfall 001 drainage ditch. As needed, catch basins would also be installed at various points along the culvert to allow for surface-water runoff to enter the culvert piping and be conveyed from the Site. Following installation of the culvert pipe, the ditch would be partially backfilled with bedding material (i.e., compacted soil fill) to create a shallower ditch capable of collecting and conveying surface-water runoff from the immediate vicinity of the ditch to the catch basins. The shallower ditch would be restored with a 6-inch surficial layer of hydric soils and planted with native wetland species to re-establish the wetland nature of the existing ditch area. Additional wetland mitigation measures are not anticipated as part of this alternative, although a final determination regarding the need for wetland mitigation would be made during the permitting process in coordination with the WDNR and the USACOE.

Given the relatively low flows in the ditch, installation of the permeable medium, sumps, culvert pipe and associated appurtenances would be performed “in the dry” using standard earthmoving equipment (e.g., excavators, loaders). To accomplish this, a bypass pumping system would be established to collect surface-water flows at an upstream point and pump them to a discharge point in the ditch downstream of the work area. Excavated materials (approximately 190 cy) would be dewatered and placed in an on-Site CAMU containment cell or transported to an appropriately permitted off-Site commercial disposal facility. The selected method for disposition of excavated materials would likely be made in conjunction with the selected corrective action approach for on-property soils.

There is no indication that DNAPL currently accumulates in the ditch; therefore, significant DNAPL accumulations are not anticipated in the trench under this approach.

This is particularly true given the fact that hydraulic gradients (a primary driving force for DNAPL) from the current bank soils toward the ditch would be reduced as a result of this alternative. Nonetheless, potentially mobile DNAPL in the vicinity of the culvert would accumulate in the permeable trench and be conveyed to the collection sumps/monitoring points. Periodic monitoring of these locations would be performed to determine whether and to what extent DNAPL accumulation may occur. If and as necessary to address DNAPL accumulations that might occur, future measures may be identified and implemented (e.g., periodic removal). However, because significant DNAPL accumulations are not anticipated based on current conditions, such measures are not included as part of this alternative.

Periodic post-construction inspections would be performed on a short-term basis (e.g., for 3 years following construction) to verify that the vegetative cover in the restored area becomes sufficiently established and to confirm that a wetland character is re-established in this area. In addition, periodic inspections at the collection sumps/ monitoring points would be conducted to assess whether any DNAPL accumulation is occurring.

Apart from the baseline institutional controls (Section 5.4), additional alternative-specific institutional controls are not anticipated for this alternative.

The estimated cost associated with this alternative ranges from $368,000 to $526,000. In accordance with NR 722.07(4)(b), this includes estimated capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs associated with this alternative. The range reflects the varying disposal methods contemplated for excavated trench material under this alternative (i.e., placement in an on-Site CAMU disposal versus off-Site commercial land disposal), which will likely be selected in conjunction with the selected corrective action approach for on-property soils. The estimated cost for this alternative does not include estimated costs associated with the construction, operation and maintenance of a CAMU; placement of materials in a CAMU will only be selected for the ditch materials if selected for on-property soils, and the CAMU-related costs are included with the associated soil alternative (Alternative S-2). The estimate also does not include the cost for establishing baseline institutional controls, which is an additional cost applicable among all alternatives regardless of the selected approach. The alternative-specific cost is summarized in Table 4 and a detailed estimate is provided in Appendix B, Table B-4.

5.3.2.2 Alternative D-2 — Excavation and Disposal of Drainage Ditch Materials

Alternative D-2 involves excavating impacted materials along the targeted portion of the Outfall 001 drainage ditch, with placement in an on-Site CAMU or disposal at an off-Site commercial disposal facility. Excavation of these materials would eliminate their potential for erosion and their ability to serve as a potential source of COPCs to surface water within the ditch. The components of this alternative (which are illustrated conceptually on Figure 6) are as follows:

- excavate impacted materials along the Outfall 001 drainage ditch
- restore excavated channel area to re-establish existing grades and function
- conduct periodic post-construction inspections to verify the performance of the remedy
- establish baseline institutional controls as described in Section 5.4

Based on existing data, it is assumed that impacted materials targeted for removal under this alternative would include ditch and bank soils extending horizontally up to 16.5 feet on either side of the channel and vertically to a depth of approximately 3.5 feet bgs over a 620-linear foot section of the channel (approximately 2,900 cy). These limits are based on visual observations made during a May 2003 reconnaissance (BBL, 2003b) and would be subject to refinement prior to implementation if this alternative is selected.

Given the relatively low flows in the ditch, excavation would be performed “in the dry” using standard earthmoving equipment (e.g., excavators, loaders). To accomplish this, a bypass pumping system would be established to collect surface-water flows at an upstream point and pump them to a discharge point in the ditch downstream of the work area. Excavated materials would be dewatered and placed in the on-Site CAMU containment cell or transported to an appropriately permitted off-Site commercial disposal facility. The selected method for disposition of excavated materials would likely be made in conjunction with the selected corrective action approach for on-property soils.

Following excavation, the ditch would be backfilled to within 6 inches of pre-excavation grades with clean fill. Six inches of hydric soils and wetland plantings would then be placed along the bottom and side slopes of the ditch to re-establish the wetland nature of the existing ditch area. Additional wetland mitigation measures are not anticipated as part of this alternative, although a final determination regarding the need for wetland mitigation would be made during the permitting process in coordination with the WDNR and the USACOE.

Specific to the ditch area, it is anticipated that periodic post-construction inspections would be performed on a short-term basis (e.g., for 3 years following construction) to verify that the restored area is functioning properly, that the vegetative cover in the restored area becomes sufficiently established and to confirm that a wetland character is re-established in this area. In the event that an on-Site CAMU is selected for consolidation of the excavated materials, CAMU-related inspections, maintenance and institutional controls would be required as described in Section 5.5.

The estimated cost associated with this alternative ranges from $815,000 to $3,212,000. In accordance with NR 722.07(4)(b), this includes estimated capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs associated with this alternative. The range reflects the varying disposal methods contemplated for excavated ditch materials under this alternative (i.e., placement in an on-Site CAMU versus off-Site commercial land disposal), which would likely be selected in conjunction with the selected corrective action approach for on-property soils. The estimated cost for this alternative does not include estimated costs associated with the construction, operation and maintenance of a CAMU; placement of materials in a CAMU would only be selected for the ditch materials if selected for on-property soils, and the CAMU-related costs are included with the associated soil alternative (Alternative S-2). The estimate also does not include the cost for establishing baseline institutional controls, which is an additional cost applicable among all alternatives regardless of the selected approach. The alternative-specific cost is summarized in Table 4 and a detailed summary of the estimated cost is provided in Appendix B, Table B-5.

5.3.2.3 Alternative D-3 — Ditch Relocation with DNAPL Migration Control Measures

Alternative D-3 involves relocating a portion of the Outfall 001 drainage ditch such that it no longer flows through the area of impacted subsurface soils. It also includes measures to mitigate the potential for migration of potentially mobile DNAPL toward the new channel under the modified hydrogeologic conditions. The specific components of this alternative (which are illustrated conceptually on Figure 7) are as follows:

- relocate the Outfall 001 drainage ditch approximately 200 feet north of its existing location

- install a DNAPL collection system in the existing ditch

- conduct periodic post-construction inspections to verify the performance of the remedy

- establish baseline institutional controls as described in Section 5.4

Under this alternative, a new ditch would be constructed to convey flow through an unimpacted portion of the facility from the point of the existing culvert discharge west of the treatment area to the point the ditch enters the culvert beneath the railroad tracks along the northwest portion of the facility. The preliminary route of the new ditch is illustrated on Figure 7. This configuration is approximately 700 linear feet in length, and would require the excavation of approximately 780 cy of materials to create the channel. It also requires the installation of a new culvert at the point where the proposed route crosses an existing railroad track in the northern portion of the facility (Figure 7). In addition, adjacent ditches converging with the Outfall 001 drainage ditch within the reach subject to relocation would need to be modified or extended so that they drain into the relocated Outfall 001 drainage ditch. Culverts would be installed at the points where these ditches cross the existing portion of the Outfall 001 drainage ditch so water does not preferentially enter and flow through the backfilled ditch. A catch basin would also be installed at the point where the relocated ditch reconverges with the existing ditch and would discharge directly to the existing culvert beneath the railroad tracks.

The new ditch would be similar in shape and character to the existing ditch and capable of conveying anticipated flows consistent with the existing channel. The banks and slopes of the new channel would be established by placing a 6-inch-thick layer of hydric soils, which would be planted with native wetland species to re-establish a wetland character in the new channel similar to that of the existing channel.

Under this alternative, measures would also be implemented along the existing Outfall 001 drainage ditch channel to minimize the potential for DNAPL migration toward the new channel under the modified hydraulic conditions. Specifically, perforated collection piping would be installed in the bottom of the existing channel and the ditch would be partially filled with granular fill. The perforated pipe would be sloped such that it drains to a collection manhole located near the current Outfall 001 location. The remainder of the existing ditch would then be backfilled with vegetated soil fill to match the surrounding grade. One layer of geotextile would be placed between the granular fill and the soil to provide stability and prevent the soil from settling into the fill layer. For the portion of the ditch downstream of the DNAPL collection manhole, a shallow ditch would be created within the backfill to allow for flow of surface water from an existing tributary to the collection basin installed at the downstream end of the existing Outfall 001 drainage ditch.

Prior to installing the perforated collection piping, approximately 6 inches of material and vegetation would be removed from the bottom of the ditch. Given the relatively low flows in the ditch, excavation would be performed “in the dry” using standard earthmoving equipment (e.g., excavators, loaders). To accomplish this, a bypass pumping system would be established to collect surface-water flows at an upstream point and pump them to a discharge point in the ditch downstream of the work area. Excavated materials (approximately 50 cy) would be dewatered and placed in the on-Site CAMU containment cell or transported to an appropriately permitted off-Site commercial disposal facility. The selected method for disposition of excavated materials would likely be made in conjunction with the selected corrective action approach for on-property soils. Following removal of the ditch bottom materials, the ditch bottom would be graded and compacted to create a suitable base and slope for the collection pipe.

At the approximate location of the current Outfall 001, the collection piping would terminate in a manhole. Using this approach, the high-permeability fill material would intercept any potentially mobile DNAPL that might be induced to flow toward the new channel with the modified hydraulic gradient. Such DNAPL, if any, would drop to the bottom of the permeable fill and be conveyed through the collection piping to the manhole, where it would settle to the bottom of the manhole.

Relocation of the drainage ditch would cause the static groundwater level in the backfilled portion of the Outfall 001 drainage ditch to be at a higher elevation than the current water level in the ditch. Accordingly, the hydraulic gradient from the surrounding soils into the permeable fill would be less than currently exists from those soils into the ditch. Because the hydraulic gradient is a primary component in potential DNAPL migration, the reduced gradient corresponds directly to a reduced likelihood of DNAPL migration into the permeable fill. Therefore, because current conditions do not suggest DNAPL accumulations in the ditch, significant DNAPL accumulations are not anticipated in the permeable fill under this approach. Nonetheless, DNAPL collected within the permeable fill would ultimately be conveyed to the manhole structure.

Periodic monitoring of the manhole would be performed to determine whether and to what extent DNAPL accumulation may occur. If and as necessary to address DNAPL accumulations that might occur, future measures may be identified and implemented (e.g., periodic removal, placement of treatment media in the manhole). However, because significant DNAPL accumulations are not anticipated based on current conditions, such measures are not included as part of this alternative.

Periodic post-construction inspections would be performed on a short-term basis (e.g., for 3 years following construction) to verify that the restored areas are functioning properly, that the vegetative cover in the restored area becomes sufficiently established and to confirm that a wetland character is re-established along the new channel route. In addition, periodic inspections would be conducted to assess whether any DNAPL accumulations occur within the collection manhole.

Apart from establishing baseline institutional controls (Section 5.4), additional alternative-specific institutional controls are not anticipated for this alternative. However, in the event that DNAPL accumulations occur within the collection manhole at some point in the future, additional institutional controls may be established to prohibit Site activities that may affect the integrity or performance of the collection system.

The estimated cost associated with this alternative ranges from $604,000 to $637,000. In accordance with NR 722.07(4)(b), this includes estimated capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs associated with this alternative. The range reflects the varying disposal methods for excavated ditch materials contemplated under this alternative (i.e., placement in an on-Site CAMU disposal versus off-Site commercial land disposal), which would likely be selected in conjunction with the selected corrective action approach for on-property soils. The estimated cost for this alternative does not include estimated costs associated with the construction, operation and maintenance of a CAMU; placement of materials in a CAMU would only be selected for the ditch materials if selected for on-property soils areas, and the CAMU-related costs are included with the associated soil alternative (Alternative S-2). The estimate also does not include the cost for establishing baseline institutional controls, which is an additional cost applicable among all alternatives regardless of the selected approach. The alternative-specific cost is summarized in Table 4 and a detailed summary of the estimated cost is provided in Appendix B, Table B-6.

5.3.3 Groundwater

The corrective action approach for on-property groundwater is natural attenuation, which consists of the following components:

- demonstrate the suitability of the Site for natural attenuation, including adequate delineation of the extent of impacted groundwater and confirmation that natural attenuation processes are ongoing and resulting in stable or decreasing trends in COPC concentrations in groundwater

- decommission 29 monitoring wells that will no longer be used for monitoring purposes

- establish institutional controls to limit groundwater use in certain areas of the Site

The approach relies on natural attenuation processes to address existing groundwater impacts. Consistent with WDNR regulations and guidance, the approach uses extensive characterization and documentation to confirm that natural attenuation is occurring. Such confirmation is required prior to WDNR approval of a natural attenuation approach. Confirmation of conditions supporting natural attenuation was obtained through investigations performed between 2004 and 2005, and summarized in a January 24, 2006 letter report entitled *Summary of Supplemental Groundwater Monitoring and Natural Attenuation Evaluation* (BBL, 2006a) and a follow-up letter to the WDNR dated April 27, 2006 (BBL, 2006d). In response to WDNR comments, further evaluations were performed between 2006 and 2007, and will be presented in a separate submittal to the WDNR. Based on all the investigations conducted to date, the following conclusions that support a natural attenuation approach for groundwater have been derived:

- operations potentially representing an active source of COPCs to groundwater are no longer occurring at the Site

- nature and extent of impacted groundwater at the Site is defined

- concentrations of COPCs in groundwater are stable or decreasing (BBL, 2006a and 2006d)

- because of the very low permeability of the clay (A and B zones) and discontinuity of the sand lenses (C zone), the potential for groundwater containing COPCs to migrate significantly from source areas, either horizontally or vertically, is very low; because of the surrounding low-permeability clay soils, any COPCs that do enter the discontinuous sand lenses are not likely to, and have not been determined to, migrate past the edge of the sand lenses

- because groundwater in the on-property portion of the Site is not used as a potable water source, there is limited potential for exposure to impacted groundwater; use of natural attenuation to address groundwater conditions that do not pose potential human health risks is consistent with NR 140.28(2)(d), wherein it is stated that an exemption can be granted for exceedances of the PAL and/or ES if "Any existing or projected increase in the concentration of the substance above the background concentration does not present a threat to public health or welfare"

- no migration of impacted groundwater to off-Site residential wells is shown to be occurring, nor is it likely because of the hydrogeologic characteristics of the Site and surrounding area; no COPCs have been detected in off-Site, downgradient residential well samples (with one exception, for which results of a confirmation sample were nondetect)

- groundwater sample data for electron acceptors, metabolic by-products, microbial indicators and other natural attenuation indicator parameters are consistent with the occurrence of COPC biodegradation and natural attenuation (BBL, 2006a and 2006d)

- occurrence of natural attenuation, which results from ambient and prevailing conditions at the Site, is expected to be sustainable for the long term

The use of natural attenuation for groundwater is also supported by the following WDNR regulations and guidance:

- NR 140.24(4) Table 5(12) — Responses when a Preventive Action Limit is Attained or Exceeded

- NR 140.26(2) Table 6(8) — Responses when an Enforcement Standard is Attained or Exceeded

- NR 726.05(2)(b)2,3 — Case Closure

- *Guidance of Natural Attenuation for Petroleum Releases* (PUB-RR-614; WDNR, 2003)

- *Guidance on Case Closure and the Requirements for Institutional Controls and VPLE Environmental Insurance* (PUB-RR-606; WDNR, 2005b)

The groundwater natural attenuation approach also involves decommissioning 29 groundwater monitoring wells at the Site that are not currently part of the RCRA unit-specific monitoring program. Locations of the wells proposed for decommissioning are shown on Figure 2. Decommissioning these wells is consistent with the requirements of NR 141, and would eliminate their potential to serve as vertical migration pathways. This approach is consistent with NR 140.24(4), Table 5, number 10 and NR 140.26(2), Table 6, number 6, which requires "remedial action to prevent or minimize the further discharge or release of the substance to groundwater."

The final component of the groundwater natural attenuation approach involves establishment of baseline institutional controls (Section 5.4), which would include controls preventing the future use of impacted groundwater at the Site for drinking water. Specifically, installation and use of potable water supply wells in certain areas of the Site with known groundwater impacts would be prohibited.

The estimated cost associated with the natural attenuation-based approach for groundwater is $100,000. This estimate is presented in Table 4 and a breakdown of the cost is provided in Table B-7 in Appendix B.

5.4 Institutional Controls

As indicated above, a key premise of the Post-Remediation HHRA (Appendix A) is the fact that the on-property portion of the Site will remain in industrial use. The exposure scenarios and areas targeted for corrective action were based on the assumption that future use of the on-property portion of the Site would be restricted to industrial purposes. So that future Site uses are consistent with this assumption, "baseline" institutional controls are applicable regardless of which of the corrective action alternatives is selected. In this case, the future use of the on-property portion of the Site will be restricted to industrial operations to be consistent with the future use scenarios evaluated in the Post-Remediation HHRA (Appendix A). The baseline institutional controls will also prevent the future use of impacted groundwater at the Site for drinking water, including prohibiting the installation and use of potable water supply wells in certain areas of the Site with known groundwater impacts.

In accordance with Wisconsin Act 418, institutional controls will be established through the Site Closure Process. Beazer will propose land and groundwater use restrictions in the Case Closure Request/Application and the final land and groundwater use restrictions will be specified in the WDNR's Closure Approval Letter. In addition to having institutional controls specified in the Closure Approval Letter, the Site will be listed in the WDNR Remediation and Redevelopment Program's GIS Registry of Closed Remediation Sites. The GIS Registry will include a link to the WDNR's Closure Approval Letter. Any maintenance requirements (e.g., alternative-specific institutional controls identified in Section 5.3, such as requirements to maintain the condition of the surface cover) will also be identified in the Closure Approval Letter and identified in the GIS Registry.

In addition to this "baseline" institutional control, certain alternatives described above also include additional controls that would apply only in the event that alternative is selected and implemented. For example, under Alternative S-1, institutional controls would likely be established to prohibit removal of the surface cover without adequate precautions and controls, including subsequent replacement of the cover materials. Such alternative-specific controls were identified above and are further discussed and evaluated (Section 6) as components of their respective alternatives. Similar to the baseline institutional controls, alternative-specific controls will be specified in the WDNR's Closure Approval Letter and identified in the GIS Registry.

The "baseline" institutional control is applicable regardless of the alternative, and is therefore not a distinguishing factor among the alternatives. Accordingly, it is not a point of comparison among alternatives in Section 6.

5.5 On-Site CAMU

As indicated in the alternative descriptions in Section 5.3, multiple alternatives include provisions for placement of excavated materials within an on-Site CAMU containment cell. NR 664 Subpart S defines a CAMU as "an area within a facility used only for managing remediation wastes for implementing corrective action or cleanup at the facility." With the expectation that removal-based alternatives may potentially be appropriate for the Site (both for the on-property areas addressed in this Focused CMS Report and the areas beyond the property boundary to be separately addressed), Beazer submitted a *Request for Modification of the Closure and Long-Term Care Plan Approval and Corrective Action Management Unit ("CAMU") Demonstration* (CAMU Demonstration Document; BBL, 2000a) to the WDNR in May 2000.

The CAMU Demonstration Document proposed an approach whereby a containment cell would be constructed within a designated CAMU area and used for the long-term management of materials generated during the corrective action activities at the Site. The purpose of the CAMU Demonstration Document was to provide necessary information to support the designation of a CAMU at the Site, including justification that the proposed approach would provide a reliable, effective, protective and cost-effective means of managing these materials. The WDNR issued a letter to Beazer dated November 1, 2000, indicating that the CAMU application was “substantially in the approval process” and was therefore “grandfathered” under the 1993 CAMU regulations (NR 664.0551). In accordance with the 1993 CAMU regulations, placement of remediation wastes in a CAMU does not constitute creation of a unit or “land disposal” subject to RCRA LDRs or Minimum Technology Requirements (MTRs).

While the specific CAMU design parameters are yet to be finalized, the general approach considered for this Focused CMS Report includes construction of a lined, bermed containment cell with a leachate collection system located within a designated CAMU area. Excavated materials would be placed into the containment cell, compacted and graded to achieve appropriate slopes. Once all of the remediation materials are placed, a surface cover (cap) would be installed on top of the consolidated materials. Additional details regarding this approach are as follows:

- Beazer and KI are currently discussing potential locations for establishing a CAMU. Accordingly, the location of the CAMU proposed in the CAMU Demonstration Document may be modified from the former landfill/landfarm area to another area of the Site that reflects KI’s revised facility operations.

- The aerial extent and configuration of the containment cell would be determined during detailed design, considering the anticipated volume of materials targeted for consolidation in the CAMU.

- For this Focused CMS Report, the containment cell is assumed to meet the landfill design requirements of NR 504. This includes a bottom liner, leachate collection system and multilayer cap. These design requirements are reflected in the cost estimate provided in Table B-8 of Appendix B. However, these requirements are not specifically applicable to the CAMU design, and are subject to further evaluation and modification as part of the CAMU design and approval process.

If a CAMU is determined to be needed at the Site, the May 2000 CAMU Demonstration Document will be amended and submitted to the WDNR. The amended CAMU

Demonstration Document would reflect the proposed CAMU location (if modified from the May 2000 proposed location), address WDNR comments regarding the previous version and provide conceptual design details for the containment cell. This would also include an assessment of the applicability and appropriateness of landfill siting criteria and performance standards of NR 504.04(4), as suggested by the WDNR in their January 22, 2004 letter to Beazer. The amended CAMU Demonstration Document would therefore serve as a basis for WDNR approval of the proposed CAMU design and detailed design of the containment cell.

If constructed, CAMU-specific operation, monitoring and maintenance activities would be performed. Such activities would depend, in part, on the final design of the containment cell. Examples of potential CAMU-specific operation, maintenance and monitoring activities include:

- periodic inspections to verify the integrity of the surface cover and the proper functioning of ancillary components (e.g., surface-water diversion measures)

- periodic mowing of the vegetated cover to prevent the establishment of deep-rooted vegetation that could affect the cover system

- repair and reseeding of any areas with excessive settlement or erosion of surface cover materials

- CAMU-specific groundwater monitoring to satisfy the requirements of NR 664, Subpart S

- operation and maintenance of any leachate collection system that may be a component of the final containment cell design

CAMU-specific institutional controls would be required in the event that a CAMU is constructed at the Site. At a minimum, CAMU-specific institutional controls are expected to include:

- prohibition on excavation or other types of disturbance within the CAMU containment cell area (except as may be necessary for maintenance of the CAMU and not without first developing an appropriate health and safety plan, and a soil management plan, unless the integrity of the CAMU is maintained during such actions)

- requirement for continued maintenance of the CAMU containment cell, including the various maintenance and monitoring activities indicated above

As indicated above, placement of excavated materials in an on-Site CAMU containment cell is a component of Alternative S-2 and, potentially, Alternatives D-1, D-2 and D-3. It is important to note that the selection of a disposal option for excavated drainage ditch materials is dependent upon the selected corrective action approach for on-property soils. A CAMU-based disposal approach would not be selected for drainage ditch materials if it is not selected for on-property soils. The use of an on-Site CAMU may also be applicable to corrective action alternatives for the portions of the Site beyond the property boundary (to be addressed separate from this CMS). Accordingly, the CAMU is not specific to one alternative, and must be considered in context of the overall corrective action approach for the Site. For those alternatives that include placement of excavated materials in an on-Site CAMU, the CAMU component is considered in the detailed evaluation of the alternative, as presented in Section 6. A summary of costs associated with construction, operation and maintenance of a CAMU containment cell is provided in Appendix B, Table B-8.

6. Evaluation of Corrective Action Alternatives

6.1 General

As required by NR 722.07, this section presents a comparative evaluation of the corrective action alternatives identified and described in Section 5. The evaluation criteria, described in NR 722.07(4) and NR 722.09(2), are identified as follows and further discussed in Section 6.2:

- long-term effectiveness
- short-term effectiveness
- implementability
- restoration time frame
- economic feasibility
- compliance with laws, standards and permitting requirements

The purpose of this evaluation is to identify the relative advantages and disadvantages of the various alternatives, and thereby support the selection of one or more alternatives as the preferred alternative(s) for the on-property portions of the Site. Specifically, the comparative evaluation is intended to identify which corrective action alternative(s) for on-property soils and the Outfall 001 drainage ditch “constitutes the most appropriate…combination of technologies to restore the environment, to the extent practicable, within a reasonable period of time…” [NR 722.07(3)(a)]. In addition, the natural attenuation approach for groundwater described in Sections 4.4.3 and 5.3.3 will be evaluated with respect to the same six criteria to demonstrate its applicability for this Site.

Alternatives for on-property soils and the Outfall 001 drainage ditch are assessed based on how well each performs relative to the evaluation criteria described in Section 6.2 **and** relative to the other alternatives considered. Site-specific considerations that affect an alternative’s performance relative to the other options are incorporated (for example, although all the alternatives may be technically implementable, factors that impact the relative ease or difficulty of implementability are considered). To aid in assessing the relative performance and in summarizing the results of the comparative evaluation, this Focused CMS Report incorporates a numerical ranking system. For each evaluation criterion, each alternative is assigned a score ranging from 1 to 5, with 1 representing the low end of the performance scale and 5 representing the high end of the performance scale. The scores are intended to reflect the relative comparisons among the alternatives considered, as well as the extent to which an alternative satisfies each criterion. The scores are presented in Table 5 and are supported by the criterion-specific considerations summarized below.

Separate comparative evaluations are provided in Section 6.3 for on-property soils and in Section 6.4 for the Outfall 001 drainage ditch. Justification for the proposed groundwater approach relative to the evaluation criteria is provided in Section 6.5. Results of these evaluations is used to identify a selected corrective action alternative for both the on-property soils and the Outfall 001 drainage ditch, and to provide additional support for the natural attenuation approach for groundwater. Based on these evaluations, the proposed overall corrective action approach is identified in Section 7.

6.2 Evaluation Criteria

The comparative evaluation of the various corrective action alternatives is based on an assessment of the performance of the alternatives relative to the technical and economic feasibility criteria identified and described in NR 722.07(4), as well as the NR 722.09(2) requirement for compliance with applicable environmental laws and standards. Based on the parameters outlined in the Wisconsin Administrative Code, the evaluation criteria used in this focused CMS are identified and the factors considered for each are briefly described below.

- **Long-Term Effectiveness [NR 722.07(4)(a)(1)]:** This criterion considers the long-term effectiveness of the alternative, including the degree to which a reduction in toxicity, mobility and volume of COPCs is achieved and the degree to which the alternative will protect public health, safety and welfare and the environment through time. It also considers the potential for the alternative to achieve the established CAOs (Section 4.2).

- **Short-Term Effectiveness [NR 722.07(4)(a)(2)]:** This criterion considers the potential for and magnitude of adverse impacts on public health, safety, welfare and the environment during the alternative's construction and implementation period. Such impacts include, but are not limited to noise, dust generation, disruption to facility operations, potential for releases and potential risks associated with on- and offsite equipment traffic. Potential impacts on workers and the community are assessed, as well as the length of time the impacts are expected to last and the extent to which engineering and/or operational controls can be used to mitigate potential impacts.

- **Implementability [NR 722.07(4)(a)(3)]:** This criterion considers the relative ease or difficulty of implementing the various corrective action alternatives in accordance with alternative- and Site-specific considerations. Both technical and administrative implementability are considered. Because all of the corrective action alternatives carried through the focused CMS process to this point include proven technologies, no pilot- or bench-scale testing will be required and there is a limited possibility for implementation issues to arise strictly due to the choice of technology. Specific implementability considerations included in this evaluation are:

  - technical feasibility of constructing and implementing the alternative at the Site
  - availability of materials, equipment, technologies and workers needed to conduct the alternative
  - potential difficulties and constraints associated with on-Site construction or off-Site disposal
  - difficulties associated with monitoring the effectiveness of the corrective action option
  - administrative feasibility of the corrective action option, including activities and time needed to obtain any necessary licenses, permits, or approvals
  - presence of any federal or state threatened or endangered species
  - technical feasibility of recycling, treatment, engineering controls, or disposal

- **Restoration Time Frame [NR 722.07(4)(a)(4)]:** This criterion considers the time required until CAOs for the various media are achieved. Because no sensitive receptors or threatened/endangered species are present within the areas addressed by this focused CMS, Site conditions are generally not conducive to short-term changes or migration of COPCs and the targeted corrective action areas are consistent among the alternatives for each area, the qualitative considerations identified in NR 722.07(a)(4)(a-f) are not a point of differentiation among the alternatives considered. Accordingly, this criterion primarily focuses on the construction and implementation time frame associated with each alternative.

- **Economic Feasibility [NR 722.07(4)(b)]:** This criterion considers the economic feasibility of a corrective action alternative by considering its cost relative to the long-term effectiveness, short-term effectiveness, implementability and restoration time frame. Cost components considered include capital costs (including both direct and indirect costs), initial costs (including design and testing costs) and annual operation and maintenance costs.

- **Compliance with Environmental Laws, Standards and Permitting Requirements [NR 722.09(2)]:** This criterion considers the extent to which the corrective action alternatives are expected to comply with applicable laws, standards and permits. Table 6 identifies the various environmental laws, standards and permitting requirements potentially applicable to the alternatives considered within this focused CMS.

6.3 On-Property Soils

The three corrective action alternatives developed to address the presence of COPCs in soils in the on-property areas of the Site targeted for corrective action (S-1 — Surface Cover, S-2 — Excavation with Placement in an On-Site CAMU and S-3 — Excavation with Disposal at an Off-Site Commercial Facility) were described in Section 5.3.1. In this section, these alternatives are comparatively evaluated with respect to the six criteria identified in Section 6.2. Results of this analysis are used as a basis for recommending a corrective action approach for the on-property soils. Scores developed for each alternative (using the numerical system described in Section 6.1) are presented in Table 5.

6.3.1 Long-Term Effectiveness

All three corrective action alternatives developed to address targeted on-property soils would provide adequate protection of public health, safety, welfare and the environment by eliminating the potential for exposure to targeted surface soils described in the Post-Remediation HHRA. Alternative S-3 (Excavation with Disposal at an Off-Site Commercial Facility) provides the highest relative degree of reduced toxicity, mobility and volume at the Site and also likely affords the best overall protection and effectiveness because the excavated materials would be permanently removed from the Site. Further, there is no potential for any component of Alternative S-3 to fail in the long term following implementation.

Alternatives S-1 and S-2 would both reduce the mobility of COPCs in the targeted soils through isolation and containment either under a surface cover (Alternative S-1) or in an on-Site CAMU containment cell (Alternative S-2); however, neither alternative would result in volume reductions at the Site. Toxicity reductions associated with both alternatives would be limited to that which occurs through time as a result of ongoing natural attenuation and biodegradation processes.

There is a potential for failure of the surface cover (Alternative S-1) or the CAMU containment cell (Alternative S-2), although proper design and maintenance of the alternatives would virtually eliminate this possibility. Because impacted materials would remain on Site with implementation of either Alternative S-1 or S-2, there would be a greater potential for future exposure to or migration of COPCs associated with those materials relative to Alternative S-3. However, proper maintenance and monitoring along with appropriate institutional controls (e.g., for Alternative S-1, prohibiting excavation or other types of surface disturbance in the targeted area without an appropriate health and safety plan and a soil management plan) would effectively mitigate this potential.

All three alternatives would achieve the Site-specific CAOs established for on-property soils. Alternatives S-1 and S-2 would mitigate direct contact through isolation and containment of the targeted soils, while Alternative S-3 achieves this goal through removal and off-Site disposal of the soils. All three also minimize the potential off-Site migration of COPCs through dissolved-phase transport (groundwater) or erosion (surface water) through isolation and containment and/or removal of targeted materials, although Alternative S-3 would provide a slightly higher degree of migration control because the impacted soils would be permanently removed from the Site. For all the alternatives, proper monitoring and maintenance of the targeted area (and for Alternative S-2, the CAMU containment cell) after implementation will be necessary to maintain the protections afforded by the corrective action during the long term. To this end, Alternative S-1 and the CAMU associated with Alternative S-2 include long-term post-implementation inspections; the excavated areas in Alternatives S-2 and S-3 would be inspected for a period of time following implementation (e.g., 3 years) to verify that these areas become suitably restored.

Institutional controls will be implemented under each alternative to limit future use of the on-property portion of the Site to industrial purposes and verify the corrective action is functioning as intended, adding to the long-term effectiveness of the alternatives.

In summary, due to the increased level of permanence and protection afforded by Alternative S-3, this alternative was assigned a score of 5. Alternatives S-1 and S-2 were both assigned a score of 4 because, although they are expected to achieve CAOs and be effective in the long term, impacted soils remain at the Site and the alternatives rely upon a higher degree of engineering and institutional controls relative to Alternative S-3.

6.3.2 Short-Term Effectiveness

Short-term impacts associated with construction and implementation of the selected corrective action exist for all three alternatives and would last for the duration of construction activities. Such impacts potentially include (but are not limited to) the following:

- working with and around construction equipment
- noise generation from operating construction equipment
- increased vehicular traffic associated with delivery of equipment and materials, and transport (on Site or off Site) of excavated materials
- dust generation during excavation and backfill activities
- potential odor generation from excavation of impacted materials
- potential for exposure to soils impacted by COPCs
- potential disruption of KI Facility operations
- wetland impacts

To the extent possible, such impacts would be minimized by engineering controls and access controls during implementation, use of dust suppression measures (as needed), use of proper health and safety practices, detailed design, and coordination with KI during the planning and implementation stages. Restoration activities associated with each alternative include restoring or creating new wetland areas to mitigate wetland impacts caused by the construction activities.

Implementation of Alternative S-1 (surface cover) presents the fewest short-term impacts because this alternative requires the least amount of soil handling. Therefore, it will result in the lowest potential for dust generation, transportation- or handling-related releases of impacted materials and disruption to facility operations. Further, this alternative represents the shortest implementation timeframe (estimated to be approximately 10 weeks, compared to approximately 35 weeks for Alternative S-2 and approximately 15 weeks for Alternative S-3), so the duration of these impacts is also lower compared to other alternatives. By comparison, Alternatives S-2 and S-3 would result in a slightly higher degree of short-term impacts associated with the additional soil handling. Specifically, these alternatives require both excavation of impacted soils and placement of fill material, thus increasing the amount of equipment traffic, project duration and corresponding disruption to facility operations. Alternative S-3 also includes off-Site transport of impacted soils and the corresponding increased local traffic and potential for transportation-related releases. Alternative S-2 includes the additional short-term impacts associated with CAMU construction (e.g., delivery of equipment and materials, access road construction, operation of construction equipment), as well as the increased implementation period of approximately 20 weeks.

Based on the considerations identified above, Alternative S-1 presents the fewest short-term impacts and the shortest implementation duration. As a result, Alternative S-1 was assigned a score of 4. Alternative S-3 was assigned a score of 3 due to the increased level of short-term impacts and time frame (approximately 15 weeks) associated with excavation and off-Site disposal. Finally, because construction of the CAMU containment cell may lead to increased short-term impacts associated with containment cell construction and a longer implementation period (approximately 35 total weeks), Alternative S-2 was assigned a score of 2.

6.3.3 Implementability

The corrective action alternatives developed and evaluated in this Focused CMS Report include only proven technologies; no pilot- or bench-scale testing would be necessary. Further, each alternative is technically implementable and all the necessary materials, equipment and workers are expected to be available regardless of the corrective action alternative selected. Adequate monitoring and maintenance activities can be established for each alternative, and no threatened or endangered species are present (given the active operational nature of the targeted area). Also, because the alternatives are anticipated to comply with applicable environmental laws, standards and permitting requirements (Section 6.3.6), each alternative is administratively feasible. The implementability issues associated with working in the vicinity of an active facility, establishing staging areas and excavating or covering soils around buildings or other structures would apply equally to all the alternatives, and could be addressed through coordination efforts with KI. Restoration activities associated with each alternative include restoring or creating new wetland areas to mitigate wetland impacts caused by construction activities. With respect to this issue, Alternative S-1 may involve “filling” of existing wetlands that would require mitigation activities such as creation of replacement wetlands. Alternatives S-2 and S-3 involve excavation of impacted soils from wetland areas; these areas could be restored to existing grades with wetland soils and plantings such that the impacted wetlands would be restored. As such, it is not anticipated that additional mitigation of wetlands (e.g., creation of replacement wetlands) would be required for these alternatives. Finally, there are no anticipated difficulties associated with the disposal methods contemplated under the various alternatives (e.g., placement in an on-Site CAMU or disposal at an off-Site commercial facility).

While there are no factors that preclude the implementability of any alternative, the key differentiating factor with respect to implementability is administrative feasibility. Alternatives S-1 and S-3 are expected to be relatively straightforward in this regard, with the exception that Alternative S-1 would likely require more coordination with the WDNR and the USACOE regarding wetland mitigation issues. However, approval of the CAMU associated with Alternative S-2 is expected to require additional administrative efforts, including the development of an amended CAMU Demonstration Document for submittal to the WDNR and a RCRA permit modification associated with the establishment of a CAMU at the Site. Coordination with the WDNR will also be required to establish the design characteristics of the containment cell. Nonetheless, the WDNR has conceptually agreed to the establishment of a CAMU at the Site (WDNR, 2000) such that the administrative requirements are not expected to limit the implementability of this alternative.

In summary, Alternative S-3 involves the fewest number of technical and administrative implementability issues and was assigned a score of 5. A score of 4 was assigned to Alternative S-1 because of the increased administrative coordination anticipated to be required for wetland mitigation issues. A score of 4 was also assigned to Alternative S-2 because of the increased administrative coordination anticipated to be required for the CAMU. While both alternatives S-1 and S-2 are implementable, it is expected that they would require a comparatively higher degree of administrative coordination relative to Alternative S-3 and the other alternatives.

6.3.4 Restoration Time Frame

As discussed in Section 6.2, this criterion effectively relates to the time required to implement each alternative (i.e., the time required until the Site-specific CAOs are achieved). While other factors may affect the time frame at which construction activities associated with a given alternative could be initiated (e.g., WDNR approval time frame, construction season, need for CAMU design, timing of any corrective action activities for off-property areas), Beazer's overall goal is to implement the selected alternative by the end of the 2009 construction season. As a result, the primary differentiating factor with regard to this criterion is the estimated length of time necessary for construction of each alternative. Based on the detailed cost estimates included in Appendix B, Alternative S-1 would require approximately 10 weeks to implement, Alternative S-2 would require approximately 35 weeks to implement and Alternative S-3 would require approximately 15 weeks to implement. Based on these relative time frames, Alternatives S-1, S-2 and S-3 were assigned scores of 5, 3, and 4, respectively.

6.3.5 Economic Feasibility

Preliminary costs, including capital costs, indirect costs (e.g., predesign investigation, institutional controls, engineering design) and post-construction operation and maintenance costs, were developed for each of the alternatives in accordance with NR 722.07(4)(b). The costs are summarized in Table 4 and detailed estimates are provided in Appendix B. Total costs for the three soil alternatives are as follows:

- Alternative S-1: $1,696,000
- Alternative S-2: $4,830,000
- Alternative S-3: $13,150,000

Alternative S-1 achieves the CAOs and provides for long- and short-term effectiveness in a short implementation time frame without any substantial implementability issues. It can also be implemented for approximately one-third the cost of Alternative S-2 and one-seventh the cost of Alternative S-3; therefore, a score of 5 was assigned for Alternative S-1. Alternatives S-2 and S-3 cost significantly more without achieving notable improvements in long- or short-term effectiveness. Further, both options would take longer (approximately 35 weeks for Alternative S-2 and approximately 15 weeks for Alternative S-3), have an increased level of short-term impacts and there are potential administrative issues related to design and construction of the CAMU component of Alternative S-2. Because neither Alternative S-2 nor S-3 achieves a level of additional protection or improved performance to justify the increased cost, and based on their costs relative to Alternative S-1, Alternatives S-2 and S-3 were assigned scores of 3 and 1, respectively.

6.3.6 Compliance with Environmental Laws, Standards and Permitting

Environmental laws and standards that are potentially applicable to implementing corrective actions at the Site are summarized in Table 6. The primary applicable requirement for on-property soils is achievement of the Site-specific soil performance standards established as provided in NR 720. All three corrective action alternatives developed to address on-property soils would meet these standards and the risk-based objectives described in the Post-Remediation HHRA. Requirements outlined in applicable permits (see Table 6) would be addressed during detailed design of the selected alternative. Accordingly, each of the alternatives was assigned a score of 5.

6.4 Outfall 001 Drainage Ditch Materials

The three corrective action alternatives developed to address the presence of COPCs within and adjacent to the Outfall 001 drainage ditch (D-1 — Culverting the Existing Ditch, D-2 — Excavation and Disposal of Drainage Ditch Materials, and D-3 — Ditch Relocation with DNAPL Migration Control Measures) were described in Section 5.3.2. In this section, these alternatives are comparatively evaluated with respect to the six criteria presented in Section 6.2. Scores developed for each alternative are summarized in Table 5. The results of this comparative evaluation are used as a basis for selecting a recommended alternative for the Outfall 001 drainage ditch (Section 7).

6.4.1 Long-Term Effectiveness

The three alternatives developed to address the Outfall 001 drainage ditch are capable of achieving Site-specific CAOs, and would result in post-construction conditions that provide for protection of public health, safety, welfare and the environment (particularly given the proactive nature of this corrective action component). With Alternatives D-1 and D-3, the existing ditch would be backfilled, thereby minimizing the potential for direct contact with ditch materials containing COPCs. Also, following implementation, surface water would either flow through a culvert (Alternative D-1) or a new channel in an unimpacted portion of the Site (Alternative D-3), thereby minimizing the potential for future releases of COPCs and/or potentially mobile DNAPL (if present) to the ditch. Similarly, with Alternative D-2, by excavating impacted ditch materials and consolidating in an on-Site CAMU or transporting off Site for disposal, the potential for direct contact with COPCs in ditch materials would be reduced, as would the potential for downstream migration of COPCs via the ditch. However, the extent to which this alternative would be effective in the long term is uncertain because the extent of removal associated with Alternative D-2 has not been definitively established and the alternative does not include a barrier to prevent future discharges to the ditch in the event potentially mobile residual materials exist following the removal and replacement of impacted materials.

Alternative D-2 would result in the permanent removal of approximately 2,900 in-situ cy of impacted materials from within and adjacent to the Outfall 001 drainage ditch, thereby reducing the volume and mobility of COPCs associated with those soils. To a lesser extent, Alternatives D-1 and D-3 also involve removal of impacted materials from the ditch (190 in-situ cy for Alternative D-1 and 50 in-situ cy for Alternative D-3). The reduction of volume and mobility of COPCs would be proportional to the volume of materials removed. In addition, if DNAPL is removed under Alternatives D-1 and D-3, further reduction in the volume and mobility of COPCs would be achieved.

All three alternatives include short-term (i.e., 3 years) post-implementation inspections to verify that the impacted areas are sufficiently restored and that the corrective action is functioning as designed. Alternatives D-1 and D-3 include additional long-term operation and maintenance associated with the culvert/catch basins, DNAPL collection sumps (Alternative D-1) and DNAPL collection pipe/manhole (Alternative D-3). Such measures would further support the long-term effectiveness of these alternatives. Long-term exposure of culverts and piping to freeze/thaw cycles may lower the long-term effectiveness of Alternatives D-1 and D-3, although it is anticipated that this issue could be adequately addressed during the design process by specifying materials that are resistant to freeze/thaw effects.

Institutional controls would also be implemented under each alternative to limit future use of the on-property portion of the Site to industrial purposes, adding to the long-term effectiveness and protection of human health, safety, public welfare and the environment.

In summary, all three drainage ditch alternatives are effective long-term approaches for addressing the presence of COPCs within and adjacent to the Outfall 001 drainage ditch. Alternative D-2 meets Site-specific CAOs, includes permanent removal of impacted materials from the ditch and requires only short-term operation and maintenance. Therefore, assuming that the extent of removal is sufficient to remove any potentially mobile DNAPL that may be present in the vicinity of the ditch, Alternative D-2 is the most protective alternative and was assigned a score of 5 with respect to long-term effectiveness. Although Alternatives D-1 and D-3 involve leaving impacted ditch materials in place, the potential for contact with these materials and downstream migration of COPCs would be minimized and Site-specific CAOs would be achieved. However, due to the long-term operation and maintenance requirements necessary to maintain the effectiveness of Alternatives D-1 and D-3, a score of 4 was assigned to these two alternatives.

6.4.2 Short-Term Effectiveness

Potential short-term impacts associated with implementation of any of the three alternatives include (but are not limited to) the following:

- working with and around construction equipment
- noise generation from operating construction equipment
- increased vehicular traffic associated with delivery of equipment and materials, and transport (on Site or off Site) of excavated materials
- dust generation during excavation and backfill activities
- potential odor generation from excavation of impacted materials
- potential for exposure to ditch materials impacted with COPCs
- potential disruption of KI Facility operations
- surface-water impacts
- wetland impacts

To the extent possible, such impacts would be minimized by engineering controls and access controls during implementation, use of dust suppression measures (as needed), use of proper health and safety practices, detailed design, and coordination with KI during the planning and implementation stages. Bypass pumping and erosion/sedimentation controls would be used to minimize the potential for surface-water impacts associated with work adjacent to the ditch. Restoration activities associated with each alternative include restoring or creating new wetland areas to replace wetlands impacted during construction activities.

The Outfall 001 drainage ditch is located away from the main work areas of the KI Facility. Accordingly, disruptions to KI activities associated with implementing the ditch alternatives are anticipated to be minimal. However, disruption to KI activities associated with on- or off-Site transportation of excavated materials (and delivery of backfill materials) under Alternative D-2 would be much greater than under Alternatives D-1 or D-3 due to the relatively large volume of materials subject to removal and disposal (and the volume of fill materials required). Alternative D-3 would involve the temporary dismantling of a KI railroad spur to facilitate installation of a culvert associated with relocation of the drainage ditch, which may also cause disruptions to KI activities.

The approximate implementation time frames for Alternatives D-1, D-2 and D-3 are 6 weeks, 8 weeks and 5 weeks, respectively. Accordingly, Alternative D-2 would result in a slightly longer duration for potential short-term impacts relative to Alternatives D-1 and D-3. In addition, due to the excavation of a much greater volume of impacted soils (2,900 in-situ cy), Alternative D-2 involves a much greater potential for odor generation and exposure to COPC-impacted ditch materials.

Based on these considerations, Alternative D-2 would result in a higher level of short-term impacts (primarily odor generation and potential exposure to COPC-impacted materials) and would require a longer time to implement relative to Alternatives D-1 and D-3. Therefore, Alternative D-2 was assigned a score of 2 with respect to short-term effectiveness. Alternative D-3 would require less time to implement and involves removal of a smaller volume of impacted materials relative to Alternative D-1, but would result in slightly more disruption to KI activities during installation of the culvert under the KI railroad spur. Accordingly, Alternatives D-1 and D-3 were both assigned a score of 4 for this criterion.

6.4.3 Implementability

The corrective action alternatives developed and evaluated in this Focused CMS Report include only proven technologies and no pilot- or bench-scale testing would be necessary. Further, each alternative is technically implementable and all the necessary materials, equipment and workers are expected to be available regardless of the corrective action alternative selected. Adequate monitoring and maintenance activities can be established for each alternative, and no threatened or endangered species are present (given the active operational nature of the targeted area). Also, because the alternatives are anticipated to comply with applicable environmental laws, standards and permitting requirements (Section 6.3.6), each alternative is administratively feasible. The implementability issues associated with working in the vicinity of an active facility and establishing staging areas would apply equally to all the alternatives, and could be addressed through coordination efforts with KI. Restoration activities associated with each alternative include restoring or creating new wetland areas to replace wetlands impacted during construction activities. Finally, there are no anticipated difficulties associated with the disposal methods contemplated under the various alternatives (e.g., placement in an on-Site CAMU or disposal at an off-Site commercial facility).

While there are no factors that preclude the implementability of any alternative, the key differentiating factor with respect to this criterion is the Site-specific implementability. Specifically, depending upon certain Site and design characteristics (e.g., culvert depth, achievable culvert slopes and source flow characteristics), the use of a culvert under Alternative D-1 may present implementability issues associated with proper Site drainage and ice accumulation in the culvert pipe. Given the extent of excavation under Alternative D-2, surface-water flow diversion and groundwater management considerations potentially represent additional technical issues associated with this approach. Under Alternative D-3, alternative-specific implementability issues are associated with the need to construct a culvert beneath an active railroad track and the anticipated construction of a portion of the relocated ditch on an adjacent property. These potential implementability issues would be addressed during detailed design of the selected alternative.

The excavation limits associated with Alternative D-2 are based on a limited data set and additional investigation would likely be required prior to implementing this alternative. Such investigations would be required to better define the anticipated removal limits and volumes, and the results could potentially impact the implementability of this alternative. Investigations would also be required prior to implementing Alternative D-3 to verify an appropriate ditch relocation route.

In summary, all three drainage ditch alternatives are technically and administratively implementable. Alternative D-1 results in fewer implementability issues relative to Alternatives D-2 and D-3, and was therefore assigned a score of 4. Due to implementability issues associated with installing a culvert under railroad tracks, obtaining access agreements with Great Northern Railroad and the need for additional investigations along the proposed relocation route, Alternative D-3 was assigned a score of 2. Alternative D-2 was also assigned a score of 2 due to the need for additional investigations to confirm the implementability of this alternative and the anticipated increased level of groundwater management during construction.

6.4.4 Restoration Time Frame

Consistent with the evaluation of soil alternatives in Section 6.3.4, this criterion effectively relates to the time required to implement each alternative (i.e., the time required until the Site-specific CAOs are achieved). Therefore, the primary differentiating factor with respect to the restoration timeframe criterion is the length of time required to implement each alternative. Based on the detailed cost estimates included in Appendix B, Alternative D-1 would require approximately 6 weeks to implement, Alternative D-2 would require approximately 8 weeks to implement and Alternative D-3 would require approximately 5 weeks to implement. Based on these relative time frames, and because each duration is reasonably short overall, all three alternatives were assigned a score of 4.

6.4.5 Economic Feasibility

Preliminary cost estimates, including capital costs, indirect costs (e.g., predesign investigations, institutional controls, engineering design) and post-construction operation and maintenance costs were developed for the three drainage ditch alternatives in accordance with NR 722.07(4)(b). These costs are presented in Table 4 and detailed cost estimate tables are provided in Appendix B. Total costs for the three drainage ditch alternatives are as follows:

- Alternative D-1: $368,000 to $526,000
- Alternative D-2: $815,000 to $3,212,000
- Alternative D-3: $604,000 to $637,000

Note that the range in costs presented above reflects the range in costs for placement of excavated materials in an on-Site CAMU (low end) versus disposal of excavated materials at an off-Site commercial facility (high end) of excavated materials. The low-end cost does not include the cost associated with the CAMU construction, which is included under Alternative S-2. Given the comparatively small removal volumes, it is not anticipated that a CAMU would be used for the selected ditch alternative if it is not also selected for the soil alternative.

Because all three alternatives would result in post-implementation conditions that are protective of human health, safety, public welfare and the environment, and would achieve Site-specific CAOs, considering the total costs presented above Alternatives D-1 and D-3 are more economically feasible than Alternative D-2 (particularly if an on-Site CAMU is not used for management of excavated materials). Accordingly, Alternatives D-1, D-2 and D-3 were assigned scores for economic feasibility of 5, 1 and 5, respectively.

6.4.6 Compliance with Environmental Laws, Standards and Permitting

Environmental laws, standards and permits that are potentially applicable to implementing corrective actions at the Site are summarized in Table 6. All three drainage ditch alternatives would meet the requirements of any applicable laws, standards and permits; such requirements would be addressed during detailed design of the selected alternative. Accordingly, all three Outfall 001 drainage ditch alternatives were assigned a score of 5 with respect to the criterion for compliance with laws, standards and permitting requirements.

6.5 Groundwater

As described in Sections 4.4.3 and 5.3.3, the corrective action approach for groundwater at the Site relies on natural attenuation and includes abandoning certain existing monitoring wells. To supplement the rationale provided in those sections and further support the use of natural attenuation, a brief comparison of the approach to the six evaluation criteria is presented below. No scores were developed for this alterative because no comparative ranking is warranted. Rather, the text summarizes the extent to which the proposed approach satisfies each evaluation criterion.

6.5.1 Long-Term Effectiveness

Section 5.3.3 provides a detailed demonstration of the effectiveness of the natural attenuation of groundwater at the Site. Implementing a natural attenuation-based corrective action alternative for groundwater would provide adequate protection of public health, safety, welfare and the environment, and achieve the Site-specific CAO for groundwater. As described in earlier sections, impacted groundwater is localized, potential for migration of COPCs in groundwater is small, impacted groundwater at the Site is not used or expected to be used as a potable source[10], no COPCs have been detected in off-Site downgradient residential well samples and concentrations of detected COPCs are stable or decreasing. Natural attenuation of COPCs in groundwater is occurring at the Site, and is expected to be sustainable throughout the long term. There would be no residual risk associated with implementation of this option because there is no exposure point for COPCs in shallow groundwater. In addition, institutional controls would prohibit the installation and use of wells for potable water supply in certain areas of the Site, further reducing the potential for future exposure to impacted groundwater.

6.5.2 Short-Term Effectiveness

Because implementation of this alternative would not involve any construction activities, there are no short-term impacts associated with the proposed approach.

6.5.3 Implementability

Natural attenuation of groundwater is both technically and administratively feasible. The evaluations requested by the WDNR for approval of natural attenuation have been completed and support the proposed approach. Abandoning selected monitoring wells is also technically and administratively feasible, and would require submittal of appropriate documentation to the WDNR and the County Health Department.

6.5.4 Restoration Time Frame

The Site-specific CAO for groundwater is to minimize the potential for off-property migration of impacted groundwater at concentrations exceeding a PAL or ES. The qualitative considerations related to this criterion [per NR 722.07(4)(a)(4)] include current and potential use of the aquifer; magnitude, mobility and toxicity of contamination; and geologic and hydrogeologic conditions. As discussed in previous sections, the impacted groundwater is primarily present within a low-yield aquitard, which minimizes the potential use of groundwater as a viable water supply for potable

[10] One active groundwater supply well is located at the facility and provides water for nonpotable purposes (i.e., hand washing). This well is screened in an unimpacted bedrock zone and has been periodically sampled to verify that COPCs are not present above the NR 140 PALs or ESs.

use. Further, the low hydraulic conductivity nature of the clay soils minimizes the potential for migration of impacted groundwater beyond its present extent. This limits both the magnitude and mobility of COPC-impacted groundwater. Ongoing biodegradation and attenuation will provide for long-term reductions in toxicity.

6.5.5 Economic Feasibility

The estimated cost to implement this alternative is approximately $100,000 (Table B-7 in Appendix B). By comparison, any form of "active" remediation for groundwater (e.g., pump and treat, enhanced biodegradation) is limited by the nature of the soils, and would be expensive and not effective at achieving WDNR PALs in the near term. Accordingly, such measures would not be cost effective relative to natural attenuation.

6.5.6 Compliance with Environmental Laws, Standards and Permitting Requirements

As discussed in Sections 4.4.3 and 5.3.3, the use of natural attenuation as a remedy for groundwater is consistent with the following WDNR regulations and guidance:

- NR 140.24(4) Table 5(12)
- NR 140.26(2) Table 6(8)
- NR 726.05(2)(b)2,3
- *Guidance of Natural Attenuation for Petroleum Releases* (PUB-RR-614; WDNR, 2003)
- *Guidance on Case Closure and the Requirements for Institutional Controls and VPLE Environmental Insurance* (PUB-RR-606; WDNR, 2005b)

Also, as discussed in Section 5.3.3, based on the demonstrated lack of human health risk posed by the COPCs present in the clay aquitard, and also in the C-zone and bedrock, NR 140.28(2)(d) provides an exemption for exceedances of the PAL and/or ES if "Any existing or projected increase in the concentration of the substance above the background concentration does not present a threat to public health or welfare."

7. Selected Corrective Action Approach

7.1 Overview

Results of the comparative analyses presented in Section 6 were used as a basis for selecting an overall corrective action approach for the on-property portion of the Site that complies with the requirements described in NR 722.09. The approach includes the following components:

- installing a surface cover to address the seven targeted areas of on-property soils representing a combined area of approximately 8.7 acres (Alternative S-1)
- culverting the portion of the Outfall 001 drainage ditch extending from the existing culvert west of the former wood-treating area to the culvert beneath the railroad near the northwest corner of the facility (Figure 5), including installation of a DNAPL collection trench beneath the new culvert (Alternative D-1)
- natural attenuation of groundwater, the ongoing occurrence of which has been documented by investigation and evaluation activities performed between 2004 and 2007 (BBL, 2006a and 2006d), including decommissioning 29 monitoring wells not currently part of the RCRA unit-specific monitoring program
- establishing baseline institutional controls, plus alternative-specific controls associated with the use of a surface cover to address soils

Based on the comparative evaluation of alternatives, this combination of measures will achieve the Site-specific CAOs and risk-based objectives established in the Post-Remediation HHRA. The rationale for selecting each component of this approach is summarized below.

7.2 On-Property Soils

As indicated above, Alternative S-1 was identified as the preferred corrective action approach to address the targeted on-property soils. This approach, which is described in Section 5.3.1.1, generally includes installing a surface cover over the targeted soil areas (Figure 4) with periodic post-construction inspection and maintenance of the cover area. It also includes establishing baseline institutional controls (land use restrictions and listing in the WDNR Remediation and Redevelopment Program’s GIS

Registry of Closed Remediation Sites), plus measures to provide for the continued integrity of the surface cover (discussed below).

Selection of Alternative S-1 to address the on-property soils targeted for corrective action is appropriate based on its ability to quickly (a construction period of approximately 10 weeks) and cost effectively (a cost less than one-third to one-seventh of the other soil options) achieve the Site-specific CAOs, with a minimum of short-term impacts and implementability concerns. Other benefits of this approach include:

- achieves the Site-specific risk-based objectives discussed in the Post-Remediation HHRA
- minimizes handling of impacted soils relative to the other alternatives
- minimizes impacts to KI operations
- meets requirements of applicable laws and standards; permitting requirements will be met during detailed design

Coordination with KI would be necessary during detailed design to provide that the final cover grade and construction (i.e., material selection) are appropriate, considering the current and intended use of the various areas subject to soil cover. Maintaining access to building doors and railroad tracks, and creating/maintaining suitable working surfaces (some areas would need to support truck traffic, while others would remain open space) would be a critical component of the final design. Maintenance plans for the covered area would be specified after the final design is established (considering the final cover types). Institutional controls associated with this approach are discussed below.

Although the comparative evaluation presented in Section 6 clearly demonstrates the surface cover alternative to be the preferred approach for targeted on-property soils, Beazer also intends to retain the potential for Alternative S-2 (Excavation with Placement in an On-Site CAMU) as a potential remedial approach for the targeted on-property soils. Two key reasons associated with the comparatively low ranking of this approach in Section 6 are the high cost and extended construction period relative to other alternatives.

The high cost is a function of the assumed design parameters for the containment cell (i.e., consistent with the NR 504 landfill requirements) and the relatively small volume of on-property soils to be excavated and placed within the CAMU (resulting in a high per-cubic-yard cost for the CAMU-based approach). To the extent that more cost-effective CAMU design parameters can be identified in coordination with the WDNR, the cost associated with an on-Site CAMU could be substantially decreased. In addition, Beazer anticipates that an on-Site CAMU may be the only cost-effective approach for managing impacted materials that may be removed from off-property portions of the Site, pending further evaluation of those areas. In this case, the extended duration associated with CAMU construction would occur regardless of the selected approach for on-property soils. Also, the additional volume associated with those materials would substantially decrease the per-cubic-yard cost for addressing on-Site soils, provided that all of the materials are consolidated in one containment cell. Therefore, in the event that an on-Site CAMU containment cell is pursued for consolidation of materials removed from off-property areas (pending further evaluation of those areas), the targeted on-property soils would likely be excavated and placed within the on-Site CAMU, consistent with Alternative S-2 presented in this Focused CMS Report. This approach would also be contingent on the timing of the selection of corrective action alternatives for the off-property portion of the Site relative to the timing of the on-property corrective action design and construction activities. In the event these conditions occur, Beazer would provide an addendum to the WDNR describing the rationale for selecting an alternate corrective action approach.

7.3 Outfall 001 Drainage Ditch

Alternative D-1 was identified as the preferred corrective action approach to address the targeted portion of the Outfall 001 drainage ditch. This approach, which is described in Section 5.3.2.1 and illustrated conceptually on Figure 5, generally includes:

- installing a high-permeability zone (e.g., crushed stone) with periodic sumps along the bottom of the existing ditch
- installing a culvert with catch basins within the Outfall 001 drainage ditch
- performing periodic post-construction inspections
- implementing institutional controls (discussed below)

Alternative D-1 is an appropriate selection for the Outfall 001 drainage ditch based on the fact that it could achieve an appropriate level of long-term effectiveness with a minimum amount of implementability issues and manageable short-term impacts. The necessary construction period of approximately 6 weeks and the cost range of $368,000 to $526,000 are comparable to those for Alternative D-3, and implementability concerns associated with Alternative D-3 will be avoided. Other benefits of this approach include:

- achieves Site-specific CAOs
- minimizes potential for both direct contact with and downstream transport of impacted ditch materials
- presents the most manageable short-term impacts relative to the other alternatives
- minimizes disruption to KI activities
- meets requirements of applicable laws and standards; permitting requirements will be met during detailed design

With respect to this alternative, KI has expressed concerns about the possibility that freezing in the culvert during the winter months could cause water and snow melt to back up into the facility. This potential issue will be further examined and evaluated prior to implementing this approach. If it is determined that drainage issues are likely to occur as a result of the culverting approach, then in-situ containment/isolation of the impacted drainage ditch materials could be accomplished by installing an engineered cap within the targeted portion of the ditch. This would functionally serve the same purpose as the culvert (to provide a barrier against the discharge of potentially mobile DNAPL from the adjacent soils into the ditch) and would provide for post-implementation channel conditions consistent with the existing conditions.

Under this approach, periodic post-construction inspections would be performed for a short period following construction (e.g., 3 years) to verify that the culvert (or engineered cap) is performing as expected. The collection sumps and monitoring points would also be inspected during this period to assess whether any DNAPL accumulation is occurring. If so, an extended monitoring period and/or additional DNAPL removal measures may be warranted. However, because there is no current evidence of significant discharges to the ditch, and because this approach is expected to reduce the hydraulic gradient (driving force) from the adjacent soils into the ditch, significant DNAPL accumulation is not expected to occur in the sumps under this approach.

7.4 Groundwater

The natural attenuation-based approach proposed for on-property groundwater has been described and justified in prior documents (including the Phase III RFI Report [Fluor Daniel GTI, 1997b] and the *Summary of Supplemental Groundwater Monitoring and Natural Attenuation Evaluation* [BBL, 2006a]), and further support is provided in Sections 4.4.3, 5.3.3 and 6.5 of this Focused CMS Report. A natural attenuation-based approach is appropriate for this Site because the nature and extent of groundwater impacts is sufficiently defined, impacted groundwater is localized, potential for migration of COPCs in groundwater is limited, impacted groundwater is not used or expected to be used as a potable source, no COPCs have been detected in off-Site downgradient residential wells, concentrations of detected COPCs are stable or decreasing and natural attenuation of COPCs in groundwater has been shown to be occurring at the Site, and is expected to be sustainable throughout the long term.

7.5 Institutional Controls

Institutional controls are included as part of the selected approach based on three considerations. First, as described in Section 5.4, a land use restriction is necessary to provide that future on-property Site uses remain industrial, consistent with the assumed exposure scenarios evaluated in the Post-Remediation HHRA (Appendix A). The use of land use restrictions is consistent with NR 720.11(1)(c), NR 722.07(5)(b) and an October 17, 2001 letter from the WDNR to Beazer. Land use restriction will be implemented as described in Section 5.4.

Second, institutional controls may be required to provide for the continued effectiveness of the selected soil alternative. Specifically, institutional controls would be used to establish a prohibition on excavation or other disturbances in the surface cover area without an appropriate health and safety plan, and a soil management plan, and without subsequent replacement of the cover materials

Third, because groundwater exists at the Site above regulatory levels, groundwater use restrictions are required to minimize future potential risks associated with consumption of impacted groundwater. Such restrictions would prohibit the installation and use of potable water supply wells in certain areas of the Site with known groundwater impacts.

In accordance with Wisconsin Act 418, institutional controls would be established through the Site Closure Process. Beazer would propose land and groundwater use restrictions in the Case Closure Request/Application and the final land and groundwater use restrictions would be specified in the WDNR's Closure Approval Letter. In addition to having institutional controls specified in the Closure Approval Letter, the Site will be listed in the WDNR Remediation and Redevelopment Program's GIS Registry of Closed Remediation Sites. The GIS Registry will include a link to the WDNR's Closure Approval Letter. Any maintenance requirements (e.g., requirements to maintain the condition of the surface cover) would also be identified in the Closure Approval Letter and identified in the GIS Registry.

8. References

AMEC Earth and Environmental, Inc. 2007. *Post-Remediation Human Health Risk Assessment,* Westford, MA. July 2007.

ARCADIS BBL. 2007. Transmittal from David Bessingpas (ARCADIS BBL) to James Hosch (WDNR) re: KI Superior, WI Facility – On-Property Soil Sampling Summary Tables and Maps (March 27, 2007).

Blasland, Bouck & Lee, Inc. 2000a. *Request for Modification of the Closure and Long-Term Care Plan Approval and Corrective Action Management Unit ("CAMU") Demonstration*, *Koppers Industry, Inc., Superior, Wisconsin Facility*, Syracuse, NY. May 2000.

Blasland, Bouck & Lee, Inc. 2000b. *Supplemental Surface Water and Streambed Sediment Investigation Report – Koppers Industries, Inc., Superior, Wisconsin Facility*, Syracuse, NY. July 2000.

Blasland, Bouck & Lee, Inc. 2000c. *RFI Bedrock Monitoring Wells Report*, Syracuse, NY. July 2000.

Blasland, Bouck & Lee, Inc. 2002a. Letter from Jeffrey Holden (BBL) to James Hosch (WDNR) re: RCRA Facility Investigation Supplemental Investigation Activities – Koppers Industries, Inc. Superior, Wisconsin Facility (April 12, 2002).

Blasland, Bouck & Lee, Inc. 2002b. Letter from Jeffrey Holden (BBL) to James Hosch (WDNR) re: Proposed Modifications to the Groundwater Monitoring Program (April 19, 2002).

Blasland, Bouck & Lee, Inc. 2003a. Letter from Jeffrey Holden (BBL) to James Hosch (WDNR) re: Bedrock Groundwater Monitoring Program (April 18, 2003).

Blasland, Bouck & Lee, Inc. 2003b. Letter from Jeffrey Holden (BBL) to James Hosch (WDNR) re: Summary of May 2003 Outfall 001 Drainage Ditch Investigation (October 2, 2003).

Blasland, Bouck & Lee, Inc. 2003c. Memo from Jeffrey Holden (BBL) to James Hosch, John Robinson, and Mark Gordon (WDNR); Jane Patarcity (Beazer); Patrick Stark

(Koppers); and Brian Magee (AMEC) re: Summary of 11/21/03 Project Meeting (November 21, 2003).

Blasland, Bouck & Lee, Inc. 2006a. Letter from Robert Anderson (BBL) to James Hosch (WDNR) re: Summary of Supplemental Groundwater Monitoring and Natural Attenuation Evaluation (January 24, 2006).

Blasland, Bouck & Lee, Inc. 2006b. *Off-Property Investigation Data Summary Report*, Syracuse, NY. February 2006.

Blasland, Bouck & Lee, Inc. 2006c. Letter from Jeffrey Holden (BBL) to James Hosch (WDNR) re: Summary of On-Property Soil Sampling Data (February 22, 2006).

Blasland, Bouck & Lee, Inc. 2006d. Letter from Robert Anderson (BBL) to James Hosch (WDNR) re: Responses to WDNR's February 27, 2006 Comments on the Groundwater Natural Attenuation Evaluation (April 27, 2006).

Environmental Troubleshooters, Inc. 2002. *Wetland Delineation Report for the Koppers Industries, Inc. Superior, Wisconsin Facility*, Duluth, MN. September 2002.

EPC Engineering & Testing. 2007. *Decommissioning Report for the Treating Process, Equipment, and Buildings at Koppers Inc. Superior, WI Facility*, Duluth, MN. May 2007.

Field & Technical Services, LLC. 2007a. *2006 RCRA Annual Groundwater Monitoring Report*, Carnegie, PA. March 2007.

Field & Technical Services, LLC. 2007b. *First 2007 Semi-annual Monitoring Report.*

Fluor Daniel GTI. 1997a. *Preliminary Characterization Report, Surface Water and Streambed Sediment, Koppers Industries, Inc., Superior, Wisconsin Facility*, East Pittsburgh, PA. March 1997.

Fluor Daniel GTI. 1997b. *Phase III RCRA Facility Investigation Report - Koppers Industries, Inc., Superior Wisconsin, Wisconsin Facility*, East Pittsburgh, PA. June 1997.

Keystone Environmental Resources, Inc. 1989. *Phase I RFI Work Plan.*

Keystone Environmental Resources, Inc. 1991. *Phase II RCRA Facility Investigation Report of Findings – Koppers Industries, Inc., Superior, Wisconsin*, Monroeville, PA. June 1991.

Koppers Inc. 2007a. Letter from Leslie Hyde (KI) to Jim Ross (WDNR) re: Koppers Inc. Superior, Wisconsin Facility – Former Wood-Treating Facility Drip Pad Decommissioning (January 18, 2007).

Koppers Inc. 2007b. Letter from Leslie Hyde (KI) to Jim Ross (WDNR) re: Koppers Inc. Superior, Wisconsin Facility – Former Wood-Treating Facility Drip Pad Decommissioning (May 16, 2007).

The RETEC Group, Inc. 2002. *Groundwater Monitoring Sampling and Analysis Plan*, *KII Superior Facility, Superior, Wisconsin*, St. Paul, MN. April 2002.

Wisconsin Department of Natural Resources. 2000. Letter from Thomas J. Kendzierski, P.G. (WDNR) to Jane Patarcity (Beazer) re: Grandfathering the CAMU application for the Koppers Industries, Inc. Site, Superior, WI (November 1, 2000).

Wisconsin Department of Natural Resources. 2001. Letter from Thomas J. Kendzierski, P.G. (WDNR) to Jane Patarcity (Beazer) re: Technical Memorandum on Soil Risk Procedures for the Koppers Industries, Inc. Site, Superior, WI (October 17, 2001).

Wisconsin Department of Natural Resources. 2002. Letter from James Hosch (WDNR) to Jane Patarcity (Beazer) re: Closure and Long-Term Care Plan Approval, Groundwater Monitoring Sampling and Analysis Plan (October 29, 2002).

Wisconsin Department of Natural Resources. 2003. *Guidance of Natural Attenuation for Petroleum Releases* (PUB-RR-614). March 2003.

Wisconsin Department of Natural Resources. 2004. Letter from James Hosch (WDNR) to Jane Patarcity (Beazer) re: Comments on Progress of the Koppers Inc., Superior, Wisconsin Facility (January 22, 2004).

Wisconsin Department of Natural Resources. 2005a. *Voluntary Party Remediation and Exemption from Liability* (PUB-RR-506). June 2005.

Wisconsin Department of Natural Resources. 2005b. *Guidance on Case Closure and the Requirements for Institutional Controls and VPLE Environmental Insurance* (PUB-RR-606). August 2005.

Wisconsin Department of Natural Resources. 2006a. Letter from James Hosch (WDNR) to Jane Patarcity (Beazer) re: Comments on Summary of Supplemental Groundwater Monitoring and Natural Attenuation Evaluation, Koppers Inc., Superior, Wisconsin Facility (February 27, 2006).

Wisconsin Department of Natural Resources. 2006b. Letter from James Hosch (WDNR) to Jane Patarcity (Beazer) re: Response to Blasland, Bouck, & Lee Letter Report of April 28, 2006 – Monitored Natural Attenuation (May 22, 2006).

United States Environmental Protection Agency. 1988. *RCRA Facility Assessment*, Chicago, IL. June 1988.