
REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release
or Threatened Release of Hazardous Substances in Region 5

FEASIBILITY STUDY ADDENDUM
ALLIED PAPER LANDFILL—OPERABLE UNIT 1
Allied Paper/Portage Creek/Kalamazoo River Site
City of Kalamazoo, Michigan

WA No. 109-RICO-059B/Contract No. EP-S5-06-01

June 2015

PREPARED FOR

U.S. Environmental Protection Agency



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Feasibility Study Addendum

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Feasibility Study

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CH2MHILL®

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Introduction

This addendum describes and presents the evaluation of an additional remedial alternative for the Allied Landfill site in Kalamazoo, Michigan. Allied Landfill is Operable Unit 1 (OU1) of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (site). This additional alternative was developed by the U.S. Environmental Protection Agency (EPA) in discussion with Michigan Department of Environmental Quality (MDEQ) and the City of Kalamazoo (city) after release of the feasibility study (FS) in November 2013 (EPA 2013). The focus of this addendum is to present the description and analysis of the new alternative. Discussion of the background, site description, history, nature and extent of contamination, areas and volumes for media for which general response actions may be applied, and risks used to develop the alternatives and cost assumptions are included in the final FS (EPA 2013).

This addendum has been formatted to follow the same major section headings as in the original FS report, where appropriate, and is divided into the following sections:

- Introduction
- Description of the New Remedial Alternative
- Detailed Analysis of the New Remedial Alternative
- Comparative Analysis of Remedial Alternatives
- References

The background, site description, and history can be found in the FS with the development and detailed evaluation of the other remedial alternatives (EPA 2013). The Remedial Action Objectives (RAOs) as presented in the FS are provided in Table 1 for reference and in evaluation of Alternative 2D.

TABLE 1

Remedial Action Objectives

OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

RAO 1	Mitigate the potential for human and ecological exposure to materials at OU1 containing chemical of concern (COC) concentrations that exceed applicable risk-based cleanup criteria.
RAO 2	Mitigate the potential for COC-containing materials to migrate, by erosion or surface water runoff, into Portage Creek or onto adjacent properties.
RAO 3	Prevent contaminated waste material at the OU1 landfill from impacting groundwater and surface water.

Description of the New Remedial Alternative

Alternative 2D consists of excavation and consolidation of impacted soil with in-place containment with long-term monitoring as depicted in Figure 1. The Outlying Areas, the Monarch Historic Residuals Dewatering Lagoon (HRDL), and portions of the Bryant HRDL/Former Residuals Dewatering Lagoon (FRDLs), Former Type III Landfill, and Western Disposal Area will be excavated and consolidated into a reduced footprint within the onsite disposal areas to create a protective buffer and developable area along the creek. Outlying areas will be backfilled to original grade after excavation, with the restoration of structures like parking lots. Excavated areas in the Operations Area will be backfilled to 1 foot above the water table and revegetated to prevent erosion of these areas into Portage Creek.

Alternative 2D includes the excavation and consolidation of an estimated 920,000 cubic yards of material into an onsite landfill encompassing 27 acres. The resulting height of the landfill is estimated at an additional 41 feet above existing grade. The landfill will have side slopes of 4:1 with slopes on top ranging from 6:1 to 10:1.

After consolidation, Alternative 2D includes covering the landfill with an engineered composite landfill cap. For the purpose of FS cost-estimating, it is assumed that the cap will consist of six layers, which are as follows, from bottom to top: a non-woven geotextile, a 12-inch-thick (minimum) sand gas venting layer, a 30-millimeter polyvinyl chloride flexible membrane liner (FML) or equivalent (permeability less than 1×10^{-10} centimeters per second), a geosynthetic drainage composite layer, a 24-inch-thick (minimum) drainage and soil protection layer, and a 6-inch-thick (minimum) vegetated, topsoil layer. The proposed cap design contains the landfill cap components required under the Natural Resources and Environmental Protection Act (NREPA), as amended, Part 115.

Stormwater management and erosion control measures are assumed to consist of two bench drains, riprap, culverts, and piping before discharging to two 1-acre stormwater detention ponds. An active landfill gas collection system would be included to collect landfill gases to prevent migration or accumulation of landfill gases that could compromise the cap.

The existing sheet pile wall will be evaluated during design to determine if it can be removed completely or is required to stabilize either the base of the landfill or backfilled areas along Portage Creek. If the wall is required for stabilization, it will be cut off at ground surface and may be modified to allow groundwater flow to the creek, eliminating the need for the existing collection system.

Alternative 2D includes long-term inspections and maintenance of the existing and newly installed engineered landfill cap, and the remaining sheet pile, if present. A long-term groundwater and landfill gas monitoring program will be implemented to verify the performance of the remedy, demonstrate that groundwater quality conforms to applicable criteria, and to provide for the appropriate management of landfill gas. The groundwater monitoring network, consisting of existing and new monitoring wells (as needed), will be located in a clean buffer outside areas where waste remains in place before groundwater would migrate offsite. The groundwater monitoring plan would also evaluate upgradient groundwater concentrations for determination of local background conditions. For the purposes of the FS, it was assumed that 20 groundwater monitoring wells will be installed as part of Alternative 2D.

A monitoring plan will be developed by EPA to monitor the performance of the remedy to meet RAO 3. The monitoring wells will be sampled in accordance with NREPA Part 201 and (40 *Code of Federal Regulations* [CFR] § Section 761.75(b) (6)). Following each sampling event, the analytical results will undergo data validation, and the validated analytical results will be compared to Michigan Act 451 Part 201 Generic Screening Criteria. Analytical results from groundwater samples collected from monitoring wells adjacent to Portage Creek will be compared to the groundwater–surface water interface (GSI) criterion to demonstrate compliance with GSI criteria at Portage Creek under Michigan Compiled Laws (MCL) 324.20120e for containment alternatives. Analytical results for samples taken from wells screened in deeper aquifers not discharging to Portage Creek will be compared to other appropriate criteria (for example, drinking water criteria).

Alternative 2D includes subalternatives for hydraulic control of groundwater if necessary. For subalternative (i), EPA would install a groundwater collection and treatment system. The groundwater collection and treatment system would consist of groundwater extraction wells and a series of sumps and lateral drain lines. For subalternative (ii), a grout slurry wall would be installed downgradient of the landfill to contain impacted groundwater located within OU1. The slurry wall would extend approximately 40 feet below ground surface based on current sheet pile wall design. It is assumed that the slurry wall will not necessarily key into clay or bedrock—portions of the slurry wall at this depth would still terminate in the upper sand zones.

Subalternative (ii) includes the same groundwater collection and treatment system as subalternative (i).

Alternative 2D includes restrictive covenants to prevent exposure of polychlorinated biphenyls (PCBs) at depth and prohibit interference with the cap, informational devices, and access restrictions consisting of security fence as needed with posted warning signs.

The areas subject to excavation, adjacent to Portage Creek, would be available for at least commercial or industrial redevelopment after implementation of the remedy. Placement of additional fill to reach desired grade for redevelopment or other enhancements to promote redevelopment, are not included within this remedy. Provided that additional material is placed upon the required soil protection layer, the landfill may be available for some recreational reuse.

Detailed Analysis of the New Remedial Alternative

This section presents the assessment of the new alternative against the first seven of the nine evaluation criteria.

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative 2D is expected to be an effective remedy for protection of human health and the environment. RAO 1 is achieved by mitigating the potential for human and ecological exposure to materials containing COCs above the relevant preliminary remediation goals (PRGs). RAO 2 is achieved since materials with COC concentrations above relevant PRGs would be covered with an engineered cap. The cap will mitigate the potential for migration to Portage Creek or onto adjacent properties by erosion. RAO 3 will be achieved by preventing surface water infiltration through the waste. In order to confirm that RAO 3 has been achieved, a long-term groundwater monitoring program would be implemented. Institutional controls, monitoring, and maintenance of the Bryant HRDLs/FRDLs Landfills are critical components for maintaining protectiveness over time.

Alternative 2D would also include a long-term inspection and maintenance program. Landfill gas and groundwater monitoring, and long-term inspection and maintenance activities would be conducted to assess whether the remedy is functioning as intended and to ensure that GSI criteria are met.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2D would achieve Applicable or Relevant and Appropriate Requirements (ARARs). Specific ARARs are summarized as follows:

- **Clean Water Act.** Section 404 of the Clean Water Act applies to the discharge of dredge and fill material into the waters of the United States, including wetlands. Superfund policy is to require a minimum of 1 acre of wetland mitigation for each acre of wetland filled. (See “Considering Wetlands at CERCLA Sites” OSWER 9280.0-03.) Alternative 2D will comply with the Federal Mitigation Rule set forth at *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule* 40 CFR § 230.94(c)(2-14), because at least 1 acre of wetlands will be mitigated for each acre of wetland filled and a restrictive covenant will be implemented to maintain the wetland area. Alternative 2D will achieve this ARAR.
- **Part 201, Environmental Remediation, of NREPA, 1994 PA 451, as amended (Part 201).** Alternative 2D would reduce the potential for exposure to COC-containing residuals/soils, address the potential migration of COC-contaminated material, and achieve a degree of protectiveness for the property, as required in Part 201, Sections 20120a, 20120b, and 20120e. Groundwater monitoring data collected in 2014 showed that shallow groundwater was below generic GSI criteria under MCL 324.20120e between the waste management boundary and Portage Creek. GSI criteria may not apply in deeper wells where the aquifer is not believed to be hydraulically connected to Portage Creek. Alternative 2D includes installation of additional groundwater monitoring wells to monitor the performance of the remedy and demonstrate compliance with GSI criteria at and near Portage Creek under MCL 324.20120e. Alternative 2D would satisfy the requirements for long-term monitoring and achieve the requirement to restrict future land use. This alternative includes restrictive covenants for areas that exceed the cleanup level for residential use and for containment areas as required in MCL 324.20114c.
- **Part 31, Water Resources Protection of NREPA, 1994, PA 451, as amended (Part 31).** In accordance with the federal Water Pollution Control Act and the federal Clean Water Act, this state ARAR establishes state criteria for rivers, creeks, and floodplain areas, to protect aquatic life and human health. It also establishes water quality standards and monitoring requirements for discharge effluents including stormwater and venting groundwater, specifying standards for several water quality

parameters, including COCs. Alternative 2D is required to meet the GSI requirements for venting groundwater under MCL 324.20120e, and thus is expected to meet the groundwater venting requirements for Part 31.

- **Part 55, Air Pollution Control, of NREPA (Part 55).** This state ARAR establishes the requirements for air emissions. Current COC emissions are within acceptable limits. Excavation of COC-containing materials and disturbance of the current landfill surfaces and perimeters during construction could result in increased air emissions. Therefore, best management practices should be implemented to minimize airborne emissions during construction and remedy implementation to mitigate unacceptable air emissions. A health and safety plan would need to be developed to monitor emissions, prevent worker and community exposure, and confirm compliance with this ARAR.
- **Michigan Public Act 451, Part 303—Wetlands Protection.** This ARAR establishes rules regarding wetland uses. Alternative 2D is anticipated to comply with this ARAR.
- **Part 91, Soil Erosion and Sedimentation Control of NREPA, 1994 PA 451, as amended (Part 91).** This ARAR establishes requirements to minimize soil erosion and sedimentation. The ARAR requires that an “earth change” (excavation, filling, or grading) be designed, constructed, and completed in a manner that limits the exposed area of any disturbed land for the shortest possible period of time, as determined by the local enforcing agency. It also requires the design of temporary or permanent control measures constructed for the conveyance of water around, through, or from the earth change area to limit the water flow to a non-erosive velocity. The ARAR requires installation and maintenance of temporary silt fences or other structures as necessary to minimize erosion and sedimentation during construction activities. Alternative 2D will comply with this ARAR by preparing and properly implementing a soil erosion and sedimentation control plan in accordance with Part 91.
- **TSCA, 40 CFR § 761.61.** This ARAR applies to the cleanup and disposal of PCB Remediation Waste. Alternative 2D meets the standards of 40 CFR § 761.50(b)(3)(i)(A) for remediation and will not pose an unreasonable risk of injury to health or the environment pursuant to 40 CFR § 761.61(c) for the following reasons: (1) This alternative will meet the PCB PRGs set forth in the FS (EPA 2013) for surface soils, subsurface soils, sediments, and groundwater, and (2) a cap will be constructed over the landfill to eliminate direct-contact hazards and minimize infiltration of precipitation through the landfill and subsequent migration of residuals or leachate from the landfill into the adjacent areas. The cap exceeds the impermeability requirements set forth in 40 CFR §761.75(b)(ii) (referenced in 40 CFR § 761.61(a)(7)) through the inclusion of a 30-millimeter polyvinyl chloride FML or equivalent with a permeability less than 1×10^{-10} centimeters per second). This is more protective than the 1×10^{-7} centimeters per second permeability requirement of 40 CFR § 761.61(7) and by reference 40 CFR 761.75(b)(ii). The performance criteria in 40 CFR §761.75(b)(iii) through (v) are specific to soil caps and are not relevant with the use of a FML. In addition, this alternative includes restrictive covenants incorporating the restrictions set forth in 40 CFR 761.61(a)(8).
- **Michigan Public Act 451, Part 115—Solid Waste Management.** The Part 115 rules promulgated for the cover design, groundwater monitoring, hydrogeologic monitoring, and construction quality control requirements for a Type III sanitary landfill would be relevant and appropriate for Alternative 2D. Alternative 2D will comply with this ARAR by including the cap layers and post-construction monitoring required under Part 115 in the cap for the landfills.

Balancing Criteria

Long-term Effectiveness and Permanence

Implementation of Alternative 2D would generally be expected to achieve the RAOs for OU1, be effective over the long term, and maintain protection of human health and the environment after the remedial action has been completed. Isolation of COC-containing materials under an engineered cap is a

proven and reliable technology to prevent human and ecological exposure. Capping would mitigate the potential for direct contact and for COC-containing materials to migrate by air emissions, wind-blown particles, erosion, or surface water runoff into Portage Creek or onto adjacent properties, RAOs 1 and 2. Capping would minimize infiltration through the waste, reducing potential impacts to groundwater and surface water, RAO 3. Implementation of institutional controls, long-term monitoring, and maintenance would allow for the long-term effectiveness and permanence of the engineered cap.

The potential for failure of the engineered cap is low, and the remedial design will include a geotechnical investigation to evaluate the COC-containing materials that are currently in place or will be consolidated into the landfill. Features for stabilization of the landfill materials and slopes would be included in the design, as necessary, based on the investigation results. A clean setback of 200 to 500 feet between the landfill and Portage Creek reduces the potential for erosion of COC-containing materials into Portage Creek to help achieve RAO 2. Additionally, the increased setback and stabilized stream banks will reduce the potential for Portage Creek to undermine the base of the landfill. Operation and maintenance (O&M) activities would effectively identify future maintenance needs, and institutional controls would prohibit activities that could damage the cap. The details of long-term monitoring and maintenance would be developed during the remedial design and compiled into an O&M program.

Alternative 2D, along with effective implementation of institutional controls, would effectively reduce risks over the long term, and the monitoring components would provide mechanisms to assess whether the remedy is performing in a manner that satisfies the RAOs over time. The reduced footprint of Alternative 2D decreases the area requiring O&M as a part of the remedy and may reduce the number of monitoring well locations needed for monitoring.

Future use of OU1 and potential long-term reuse issues would be addressed through monitoring and institutional controls, including restrictive covenants, and access restrictions, such as signage and fencing. Alternative 2D would allow for increased potential for redevelopment, both commercial and recreational in the area away from the landfill. Limited reuse scenarios, such as recreational reuse, may be possible on the landfill itself.

Consolidating contaminated residuals and creating a larger clean buffer area along Portage Creek results in more area being available for redevelopment and productive reuse. By implementing an alternative that allows for productive use, the amount of long-term stewardship and the reliability of controls, such as institutional controls, may be increased. Productive reuse of a site and stakeholder support of the property's reuse may result in an increased interest in maintaining the effectiveness of the remedy (EPA 2010). Encouraging site reuse to achieve enforcement and environmental protection goals, such as long-term stewardship and sustainable land use planning, helps remove obstacles to cleanup and revitalization (EPA 2014).

A constant presence at the landfill and the adjacent properties may provide a more effective deterrent to trespass and associated activities that can damage the engineered cover system. The OU1 site is currently secured by a fence, but trespassers have been found on the site camping. Campfires used for heat or cooking can damage the vegetative cover on the landfill making the protective soil cover more susceptible to erosion. The stewardship and reuse is expected to deter trespassing and provide some additional security to the site over the life of the remedy.

As a part of the O&M for the remedy, there will be regular inspections of the landfill, estimated on a quarterly basis. Regular maintenance of the reuse areas would likely happen more frequently. Though inspections and maintenance associated with redevelopment may not be specific to the remedy, they would provide an opportunity for more frequent observation of the remedy performance. With increased monitoring, common issues with landfill covers, like erosion or settling issues, may be observed early and could potentially be addressed before they worsen and require major actions to repair.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2D uses containment to reduce the mobility of COC-containing materials without treatment. Treatment is most important for COCs that are mobile in the environment. As discussed in the remedial investigation report (MDEQ 2008) and FS report (EPA 2013), PCBs tend to be relatively immobile in the environment, and at OU1 are most prone to migration where they are exposed to erosion. Based on the combined effects of high affinity for PCBs to adhere to the residual and the low hydraulic conductivity, it is understood that PCBs do not migrate significantly from the residual material. In situ treatment to reduce mobility (stabilization) would be of little benefit since PCB concentrations in groundwater do not exceed criteria, with the exception of wells screened within or immediately adjacent to the residuals. Stabilization would likely also cause a significant increase in volume of waste due to the addition of solidifying agents. As a result, the isolation of PCB-containing materials in place through consolidation beneath an engineered cap is expected to effectively address the mobility of PCBs and other COCs associated with potential migration by erosion. Treatment to reduce the volume or toxicity is not included in Alternative 2D.

Short-term Effectiveness

Alternative 2D provides an acceptable degree of short-term effectiveness. There is the potential for a short-term increase in COC exposure to workers due to potential disturbance of COC-containing residuals as part of site preparation and implementation of the alternative; however, compliance with dust-control procedures (appropriately wetting materials) and proper health and safety procedures (for example, monitoring and use of personal protective equipment as described in a health and safety plan) to be developed during remedial design would effectively mitigate the short-term impacts and protect onsite workers from hazards during construction (for example, working around heavy equipment).

The primary short-term impacts to the community include increased noise, the potential for dust-borne releases, and increased traffic. Truck traffic in local residential neighborhoods would increase throughout the duration of the project. Under Alternative 2D, materials excavated from the Outlying Areas and Monarch HRDL would be trucked for consolidation on the landfill and clean fill would be hauled in to fill the excavations.

The excavations may reach 15 to 20 feet below grade or more, and are expected to require benching, sheet pile, and/or other temporary shoring alternatives to allow removal to target depths. The installation and removal of sheet pile will create noise and cause vibrations in the immediate area during the period of construction, potentially disturbing nearby property owners/occupants. Additional short-term environmental impacts are associated with the potential for offsite migration due to dust-borne releases or incidental releases to Portage Creek. The dust-borne releases could be readily mitigated by keeping the excavation/consolidation areas/materials appropriately wet.

Reasonable and appropriate controls (for example, silt curtains) would be implemented when removing materials that lie close to Portage Creek and wetland areas of OU1 to mitigate impacts to the aquatic environment. Areas disturbed during implementation would be restored after construction with appropriate native plantings (or restored as wetland areas, if appropriate). The estimated duration to complete Alternative 2D is approximately 3 years. The installation of the engineered caps would be conducted during the standard Michigan construction season, which is typically early April through the end of October, weather-dependent.

Implementability

Implementation of Alternative 2D includes the following major components: excavation and consolidation, construction of engineered caps, installation of a stormwater management system, landfill gas monitoring, restoration, and O&M activities, groundwater monitoring, and the implementation of institutional controls. Groundwater collection and treatment or slurry wall installation are considered as subalternatives to groundwater monitoring and are evaluated in the FS report (EPA 2013). The process options incorporated into this alternative are proven remedial options and have been implemented successfully on environmental

cleanup projects throughout the country. Technologies for the installations of engineered caps are well established, widely applied, and are proven to be reliable over long periods of time at sites of similar size and characteristics.

The excavation depths of the Outlying Areas, such as the Alcott Street and Goodwill parking lots, could extend as deep as 15 to 20 feet below ground surface. Given this depth and the adjacent buildings, the excavations would need to be stabilized. For purposes of this FS addendum, it was assumed that temporary steel sheeting would be used. Special implementation methods will be required to drive the sheets while minimizing the potential for damage to the adjacent structure, for example, trenching and predrilling, and pile driving using low vibratory methods may be used to minimize impacts. Crack, vibration, and settlement monitoring will be required to verify sheet pile installation is not causing damage to adjacent properties.

The excavation and consolidation activities at the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL are also estimated to require excavation to depths of 20 feet below ground surface. Excavation to a depth of 20 feet below ground surface significantly increases the likelihood of encountering groundwater—as a result, supplemental engineering controls would be necessary to manage groundwater in the saturated fill. Such engineering controls would likely include a combination of excavation reinforcement (such as sheeting), dewatering, and soil stabilization. If a significant head differential exists between the groundwater table and the base of the excavation, a potential for creating hydrostatic pressure at the base of the excavation exists. Concerns relating to hydrostatic pressure may be minimized through engineering controls such as lengthening the flow path (for example, if sheeting is used, increasing the embedment depth) and installing piezometers for monitoring vertical hydraulic gradients. While such groundwater management measures will present additional design and construction challenges, they are technically feasible and implementable. The excavation activities are assumed to be completed with conventional earth-moving equipment. Dewatering and erosion and sedimentation controls, such as silt fence, would also be required around wetland areas.

The landfill in Alternative 2D has a reduced footprint and increased volume, thereby increasing the height of the landfill and pressure exerted on the underlying ground surface. Geotechnical testing will be required on materials requiring excavation as well as the underlying materials in the location of the landfill to evaluate the need for additional stabilization prior to consolidation. Additional slope stabilization measures and settlement monitoring will likely be required due to the increased height of the landfill.

Support services and sufficient quantities of construction materials are expected to be readily available, and qualified commercial contractors are available locally to perform the work. Since OU1 is part of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, permits are not required for onsite activities; however, meeting the substantive applicable requirements of federal and state regulations is required.

Implementation of a sitewide groundwater monitoring program requires the installation of monitoring wells and sampling. Sitewide monitoring programs have been implemented successfully on cleanup projects throughout the Kalamazoo River OUs and across the country. Institutional controls at the OU1 property should be easily implemented by Lyondell, the bankruptcy Trustee. It will likely be more challenging to implement institutional controls at the Goodwill property; however, they are implementable as evidenced by the existing institutional controls there.

Cost

Costs for Alternative 2D are associated with the following construction activities: project-area preparation, excavation and consolidation, installation of the engineered cap, stormwater management, restoration, and long-term monitoring and maintenance. Costs for Alternative 2D include groundwater monitoring in the base remedy cost. The Alternative 2D cost estimate is provided in Appendix A.

The total estimated capital cost of implementing Alternative 2D is \$57 million, and the total estimated O&M cost is \$5.7 million. The total estimated periodic cost for 5-year reviews is \$110,000. The total estimated 30-year present-worth cost associated with implementation of Alternative 2D is \$63 million.

Modifying Criteria

While a preferred remedy has not yet been selected by EPA, and the proposed plan has not been released, there has been significant input provided by the public and the City of Kalamazoo on the remedial alternatives presented in the FS report (EPA 2013). Based on the comments/input from public meetings and meetings with the City of Kalamazoo, total removal, such as Alternative 3, is the preferred remedy. However, Alternative 2D was developed in coordination with the City of Kalamazoo and MDEQ to allow for potential redevelopment of portions of OU1 to address concerns of the city and public.

Comparative Analysis of Remedial Alternatives

A comparative analysis of the remedial alternatives against each other in consideration of the two threshold and five balancing criteria was performed. The analysis described in the following subsections was conducted in the context of how Alternative 2D compares with FS alternatives in meeting the evaluation criteria.

Overall Protection of Human Health and the Environment

Alternative 2D is expected to be an effective long-term remedy for OU1, consistent with Alternatives 2A, 2B, 2C, 3, and 4. Under these alternatives, the three RAOs would be achieved, and ARARs would be met. Alternative 1 would provide no improved protection over the current conditions, would provide no risk reduction, and would not be protective of human health or the environment. No RAOs would be achieved by Alternative 1.

The overall protectiveness to human health and the environment is similar for each active remedial alternative as long as all elements of the remedy, including O&M and monitoring, are properly maintained, RAOs 1 through 3 would be achieved for Alternatives 2, 3, and 4, the significant difference being that with increasing complexity of remedy, there are increased short-term risks.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2D complies with ARARs, consistent with Alternatives 2A, 2B, 2C, 3, and 4. Alternative 1 would not achieve ARARs. A detailed evaluation of ARARs is provided in Appendix B.

Long-term Effectiveness and Permanence

Alternative 2D, with each of the remaining alternatives except Alternative 1, would be expected to meet RAOs 1 through 3 and provide long-term effectiveness and permanence once the RAOs are met. The active alternatives are combinations of proven and reliable remedial processes, and the potential for failure of any individual component is low.

Alternative 2 options, including Alternative 2D, and Alternative 4 would achieve long-term effectiveness through onsite containment of the material with COCs above PRGs as a primary component of the remedy, with O&M, monitoring, and institutional controls to collectively ensure and verify the permanence of the remedy. Alternative 2D would require additional O&M for the active landfill gas collection system and for additional slope stabilization measures due to the increased height of the landfill. However, the long-term effectiveness and permanence of Alternative 2D are enhanced by an increased clean buffer between the landfill and Portage Creek and long-term stewardship to help facilitate the monitoring and maintenance of the cap.

Under Alternative 3, no long-term O&M or monitoring would be required onsite with the exception of areas where waste is left in place because of the proximity to buildings. Materials with COC concentrations above relevant PRGs would be excavated and disposed of offsite. The large-scale removal and offsite disposal of materials presented in Alternatives 3 provides an added degree of permanence at OU1 through removal.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2D reduces the mobility of COCs through isolation and containment as do Alternatives 2A, 2B, 2C, 3, and 4. Alternative 2C is the only alternative that would result in a reduction of toxicity or volume by treatment with the offsite incineration of a portion of excavated soils. Alternative 1 does not reduce the toxicity, mobility, or volume of COC-impacted materials.

Short-term Effectiveness

The evaluation of short-term effectiveness criterion are primarily related to the area and volume of COC-containing materials addressed in each alternative, the time necessary to implement the remedy, potential

risks to workers, and potential impacts to the community during construction. Short-term effectiveness is summarized in Table 2.

With the exception of Alternative 1, all the alternatives with active remedial components would have some short-term impacts, including increased noise from construction vehicles, the potential for airborne dust releases, increased traffic in the vicinity of OU1, increased wear on local roads, increased potential for workers to come in contact with PCB-containing materials, and other risks associated with construction work. Alternatives 2A, 2B, and 2C require the least amount of disturbance and shortest construction time (approximately 2 years). The impacts can be effectively addressed through implementing a project-specific health and safety plan, keeping excavation areas properly wetted, planning truck routes to minimize disturbances to the surrounding community, and other standard best management practices.

Alternative 2D has an increased construction duration (estimated at 3 years) due to the additional excavation and consolidation volume. Alternatives 3 and 4 present greater short-term impacts because of the amount of materials required to be moved and the increased construction duration (estimated at 5 and 10 years respectively). The additional volume of materials to be handled in Alternatives 2D, 3, and 4 result in an increase in truck traffic near OU1 during the project and an increased risk for vehicular accidents.

There are additional qualitative impacts to the local community, such as noise and dust, for a period of 5 years (Alternative 3) to 10 years (Alternative 4), which will place an increased burden on the community. There are no short-term impacts associated with construction or implementation for Alternative 1; however, since existing measures in place to control access to OU1 would not be maintained, there could be an increased risk of direct exposure over the short term to individuals who trespass and come into contact with surficial materials containing COCs above the PRGs.

Implementability

The primary remedial components of Alternative 2, 3, and 4 are proven, readily implementable, have been used successfully as part of other environmental cleanup projects, and they are expected to be reliable over the long term. Alternatives 2, 3, and 4 could be completed using readily available conventional earth-moving equipment, and most of the necessary services and construction materials are expected to be readily available.

Alternative 2D is more difficult to implement than Alternatives 2A, 2B, and 2C due to the reduced landfill footprint and increased excavation and consolidation volumes. Additional stabilization measures may be required for the underlying soils prior to consolidation and slope stabilization measures and settlement monitoring may be required due to the increased height of the landfill.

Alternatives 3 and 4 are more difficult to implement due to different constraining conditions. For Alternative 3, the availability of solid waste and/or Toxic Substances Control Act (TSCA) landfills to accept the volume of materials to be disposed of offsite would be a limiting factor in terms of construction progress and overall cost. The limited staging area available for excavated materials during construction of the containment cells would be a limiting factor for Alternative 4. Alternatives 3 and 4 are also more difficult to implement because of the requirement to characterize and evaluate material for disposal or beneficial onsite reuse due to the heterogeneity within the HRDLs and FRDLs and variability of the PCB concentrations.

There are no technical or administrative implementability issues associated with Alternative 1 because no active remediation would take place.

TABLE 2
Summary of Short-term Effectiveness Considerations
OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Alternative	Total Area	Total Volume of COC-Containing Materials Excavated	Duration	Worker Risks	Community Impacts
Alternative 1	No areas addressed	No volume of impacted PCB-containing materials addressed	No time period to implement	No worker risks from implementation as no action is taken.	Potential offsite migration of COC-containing materials.
Alternative 2A	65 acres, 48 acre cap	350,000 yd ³	Approximately 2 years	Least of the active alternatives; managed by health and safety plan.	Associated with dust, noise, and truck traffic.
Alternative 2B	65 acres, 42 acre cap	479,000 yd ³	Approximately 2 years	Slightly increased due to moving Monarch HRDL; managed by health and safety plan.	Slight increase; associated with dust, noise, and truck traffic.
Alternative 2C	65 acres, 42 acre cap	479,000 yd ³	Approximately 2 years	Greater than 2A and 2B due to potential exposure during characterization and transportation.	Greater than 2A and 2B due to additional management for characterization and offsite transport.
Alternative 2D	65 acres, 27 acre cap	920,000 yd ³	Approximately 3 years	Greater than 2A, 2B, or 2C due to increased excavation and consolidation volume.	Greater than 2A, 2B, and 2C due to longer construction duration and transport of backfill materials.
Subalternative (i)	N/A	N/A	Concurrent with Alternative 2 Options, but indefinite O&M	Risks are easily managed by health and safety plan. Continued risks present with operation and maintenance of treatment system.	Slight increase over Alternative 2 options during construction due to well installation and treatment system construction.
Subalternative (ii)	N/A	N/A	Concurrent with Alternative 2 Options, but indefinite O&M	Greater risks than subalternative (i) due to construction of slurry wall. Similar O&M risks.	Slight increase over Alternative 2 options during construction due to well installation and treatment system construction. Greater than subalternative (i) due to slurry wall construction.
Alternative 3	65 acres	1,600,000 yd ³	5 years	Greater than Alternative 2 given the area/volume of targeted material; Increased travel for disposal and increased project duration.	Greater than Alternative 2; associated with noise, dust, and particularly increased truck traffic, which would average 115 trips daily in and out of OU1 for the duration of the project. Greatest number of miles driven due to volume transported to disposal facilities with limited locations.
Alternative 4	65 acres, 48 acre landfill	1,600,000 yd ³	10 years	Greater than Alternatives 2 and 3 given the area/volume of targeted material and significantly increased project duration.	Greater than Alternatives 2 and 3; associated with noise and dust over the longest project duration. Slightly fewer truck trips than Alternative 3, but 1/3 of the miles outside OU1 due to decreased volume transported to disposal facilities.

yd³ = cubic yards

Cost

The costs for the range of alternatives are summarized in Table 3. The cost estimates are consistent with FS-level of estimation, with an accuracy of +50 to -30 percent. A final cost estimate would be developed and refined during the remedial design process after the selection of a recommended remedy. The detailed estimates and associated assumptions are presented in Appendix A. Although the FS Addendum was prepared for the development and evaluation of Alternative 2D, unit rates were updated for all of the remedial alternatives for comparison purposes to account for inflation and reflect current disposal costs. Therefore, costs for all alternatives were updated to provide an accurate relative cost comparison. No assumptions were changed in the evaluation of the alternatives presented in the FS.

TABLE 3

Summary of Remedial Alternative Costs

OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Alternative	Estimated Capital Cost	Estimated O&M Cost	Estimated Periodic Cost	Total Present-worth Cost
Alternative 1	\$0	\$0	\$110,000	\$110,000
Alternative 2A	\$38,000,000	\$6,700,000	\$110,000	\$44,000,000
Alternative 2B	\$38,000,000	\$5,000,000	\$110,000	\$43,000,000
Alternative 2C	\$65,000,000	\$5,000,000	\$110,000	\$70,000,000
Alternative 2D	\$57,000,000	\$5,800,000	\$110,000	\$63,000,000
Alternative 3	\$238,000,000	\$0	\$110,000	\$238,000,000
Alternative 4	\$154,000,000	\$5,000,000	\$110,000	\$159,000,000

Summary

Table 4 provides an abbreviated comparison of the two threshold and five balancing criteria.

TABLE 4
Comparative Analysis of Alternatives
OU1 Feasibility Study Report—Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund Site

Alternative	Description	Overall Protection	Compliance with ARARs	Long-term Effectiveness	Reduction of Toxicity, Mobility or Volume through Treatment	Short-term Effectiveness	Implementability	Cost
Alternative 1	No action	Not protective. No action would be taken.	Would not meet ARARs	Not effective. Site conditions would remain the same.	No reduction of toxicity, mobility, or volume.	No worker risks. No action to be taken.	Implementable as no action would be taken.	\$110,000
Alternative 2	Consolidation and capping							
2A	Construct caps on both Monarch and Operations areas	Protective. Remaining exposed contamination would be covered and contained. Infiltration of surface water would be minimized.	Meets ARARS	Effective. Larger landfill footprint requiring O&M than Alternatives 2B, 2C, and 2D.	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 2-year period, most effective of active alternatives. Worker risk associated with dermal contact, inhalation, and ingestion. Risks are controllable. Community impacts associated dust, noise, and traffic.	Proven technology that has been implemented at similar OUs.	\$44,000,000
2B	Consolidate Monarch within Operations areas	Protective. Remaining exposed contamination would be covered and contained. Consolidation of the Monarch HRDL within the operations area would reduce the amount of monitoring required.	Meets ARARS	Effective	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 2-year period, slightly longer than 2A. Worker risk associated with dermal contact, inhalation, and ingestion. Risks are controllable. Community impacts associated dust, noise, and traffic.	Proven technology that has been implemented at similar OUs. Combining Monarch on the Operations Area would reduce the footprint of contamination.	\$43,000,000
2C	Consolidate Monarch within operations areas and transport excavated soils with PCBs >500 mg/kg offsite for incineration	Protective. Remaining exposed contamination would be covered and contained. Consolidation of the Monarch HRDL within the operations area would reduce the amount of monitoring required. Offsite incineration of some of the highest PCB concentrations would be slightly more protective.	Meets ARARS	Effective	Reduction of toxicity and volume through treatment of a portion of the material.	Implementation over 2-year period, slightly longer than 2A and 2B. Worker risk associated with dermal contact, inhalation, and ingestion due to increased management with characterization and segregation. Risks are controllable. Community impacts associated with dust, noise, traffic, and offsite transportation of contaminated materials.	Proven technology that has been implemented at similar OUs. Combining Monarch on the operations area would reduce the footprint of contamination. TSCA-permitted incinerators are limited quantity. Identifying, segregating and shipping, make 2C more difficult to implement.	\$70,000,000
2D	Consolidate Monarch and portions of Operations Areas under an approximate 27 acre cap.	Protective. Remaining exposed contamination would be covered and contained.	Meets ARARS	Effective. Increased O&M requirements over Alternatives 2B and 2C. Community stewardship may help facilitate the monitoring and maintenance of the cap and effectiveness of controls. Provides larger clean buffer along Portage Creek.	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 3-year period is longer than 2A, 2B, or 2C resulting in increases to worker risk associated with inhalation and ingestion. Community impacts associated with dust and noise during construction and increased traffic associated with trucking backfill materials.	Proven technology that has been implemented at similar OUs. Implementability challenges are increased due to the consolidation on a smaller footprint resulting in a taller landfill. Additional stabilization measures may be required.	\$63,000,000
Subalternative (i)	Groundwater collection and treatment system	Protective. Achieves RAO 3 with collection and treatment of potentially impacted groundwater.	Meets ARARS	Effective	Provides some reduction of volume through treatment of PCBs in groundwater. However, minimal contaminant mass is present in the groundwater.	Manageable risk associated with the installation of wells and construction of treatment system.	Proven technology.	\$4,400,000 for Alternative 2A \$4,300,000 for Alternative 2B, 2C or 2D

TABLE 4
Comparative Analysis of Alternatives
OU1 Feasibility Study Report—Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund Site

Alternative	Description	Overall Protection	Compliance with ARARs	Long-term Effectiveness	Reduction of Toxicity, Mobility or Volume through Treatment	Short-term Effectiveness	Implementability	Cost
Subalternative (ii)	Groundwater collection and treatment system with slurry wall	Achieves RAO 3 with collection and treatment of potentially impacted groundwater, but may create mounding or otherwise alter groundwater flow.	Meets ARARs	Effective	Provides some reduction of volume through treatment of PCBs in groundwater. However, minimal contaminant mass is present in the groundwater.	Increased short-term risks to construction worker and environment over subalternative (i) during installation of the slurry wall. Community impacts from dust, noise, and traffic associated with the slurry wall construction.	Proven technology. Implementation may result in groundwater mounding or short-circuiting around the barrier if operation of the groundwater treatment system ceased.	\$14,000,000 for Alternative 2A \$12,000,000 for Alternative 2B, 2C or 2D
Alternative 3	Total Removal and Offsite Disposal	Protective. Contamination would be disposed of at an approved landfill facility both hazardous and non-hazardous.	Meets ARARS	More effective than Alternative 2 due to removal from OU1. No cover maintenance or source for potential groundwater impacts.	No reduction of toxicity, mobility, or volume would be achieved. Volume may be increased if soils require dewatering by addition of cement.	Implementation over 5-year period. Worker risk associated with dermal contact, inhalation, and ingestion would occur over a longer period of time. Risks are controllable. Community impacts associated dust, noise, and traffic.	Proven technology, landfill space in the area could be limited requiring the hauling of waste a significant distance from OU1.	\$238,000,000
Alternative 4	Encapsulation Containment System	Protective. Little advantage achieved by construction of the liner. Compacted waste can achieve 1×10^{-7} centimeters per second hydraulic conductivity on its own limiting groundwater flow through the material.	Meets ARARS	More effective than Alternative 2. The source material is fully encapsulated further minimizing potential for groundwater impacts.	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 10-year period. Worker risk associated with dermal contact, inhalation, and ingestion would occur over a longer period of time. Risks are controllable. Community impacts associated dust, noise is the least short-term effective alternative.	Proven technology.	\$159,000,000

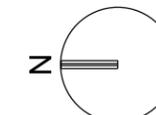
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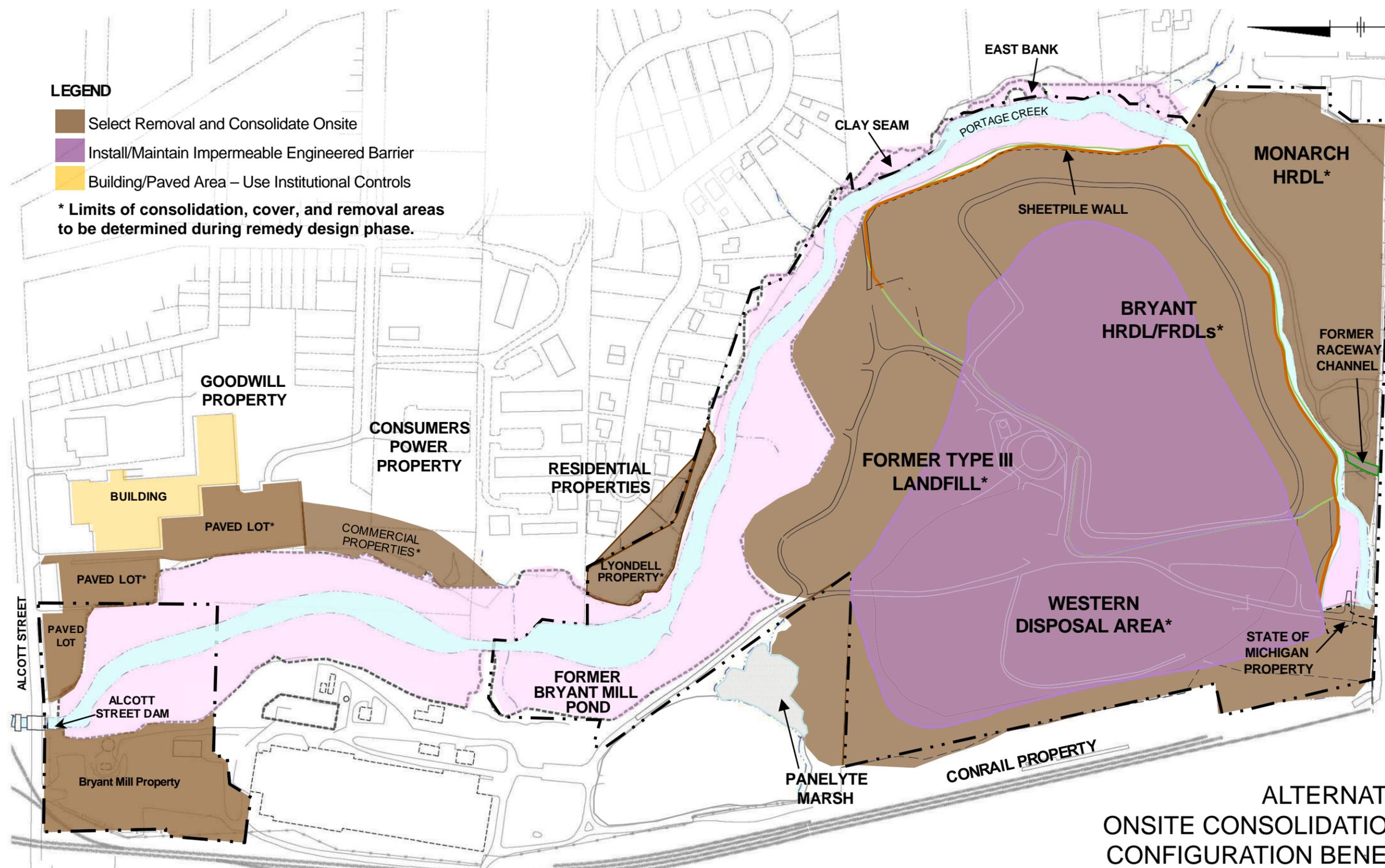
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LEGEND

-  Select Removal and Consolidate Onsite
-  Install/Maintain Impermeable Engineered Barrier
-  Building/Paved Area – Use Institutional Controls

* Limits of consolidation, cover, and removal areas to be determined during remedy design phase.



ALTERNATIVE 2D
 ONSITE CONSOLIDATION WITH ALTERNATE
 CONFIGURATION BENEATH IMPERMEABLE
 ENGINEERED BARRIER
 FIGURE 1

-  Edge of Water or Drainage Channel
-  Road/Trail
-  Approximate Property Line from County Tax Map
-  Surveyed Property Boundary
-  Previously Remediated Area



ALLIED PAPER, INC. / PORTAGE CREEK /
 KALAMAZOO RIVER SUPERFUND SITE
 ALLIED PAPER, INC. OU

Appendix A
Detailed Cost Estimates

TABLE 5-1

Cost Estimate for Remedial Alternative 1

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
TOTAL CAPITAL COST:					\$0
II. OPERATION AND MAINTENANCE (O&M) COSTS					
Discount Rate					1.9%
TOTAL O&M COST:					\$0
III. PERIODIC COSTS					
Discount Rate					1.9%
Discount					
5-Year Reviews		Annual Cost		Factor	Net Present Value
1	Year 5	\$25,000	YR	0.91	\$22,755
2	Year 10	\$25,000	YR	0.83	\$20,711
3	Year 15	\$25,000	YR	0.75	\$18,851
4	Year 20	\$25,000	YR	0.69	\$17,158
5	Year 25	\$25,000	YR	0.62	\$15,617
6	Year 30	\$25,000	YR	0.57	\$14,214
TOTAL PERIODIC COST:					\$109,304
TOTAL ESTIMATED COST:					\$109,304
ROUNDED TO:					\$109,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK= Week; MO = Month.

Item Notes (where applicable):

1 - 7 Net present value (NPV) factors calculated using the following equation:

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-2

Cost Estimate for Remedial Alternative 2A*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Site Preparation					
1	Pre-construction Field Survey	1	LS	\$5,300	\$5,300
2	Air Monitoring Program	280	DAY	\$1,600	\$448,000
3	Temporary Fencing	1	LS	\$16,000	\$16,000
4	Decontamination Area	1	EA	\$37,000	\$37,000
5	Temporary Construction Access Roads	1	LS	\$85,000	\$85,000
6	Clearing & Grubbing	20	AC	\$13,000	\$260,000
7	Temporary Steel Sheeting (Drive, Extract and Salvage: Means 31 41 16.10 0100)	0	TON	\$2,200	\$0
8	Utility Protection / Relocation	1	LS	\$106,000	\$106,000
9	Temporary Stormwater Management and Erosion and Sediment	1	LS	\$265,000	\$265,000
10	Well Abandonment	18	EA	\$640	\$11,520
Site Preparation Subtotal:					\$1,233,820
Excavation and Consolidation					
11	Survey	10	WK	\$5,300	\$53,000
12	Soil Removal and Consolidation	320000	CY	\$13	\$4,240,000
12a	Construction Water Treatment System	280	days	\$11,000	\$3,080,000
13	Confirmation Sampling	300	EA	\$530	\$159,000
14	Remove Sheet Pile Wall	2600	LF	\$120	\$312,000
15a	Soil Removal and Consolidation (setback from creek)	19000	CY	\$13	\$251,750
15b	Soil Removal and Consolidation (setback from creek)	11000	CY	\$13	\$145,750
Excavation and Consolidation Subtotal:					\$8,241,500
Final Cover System					
16	Grade Verification Surveys	8	WK	\$5,300	\$42,400
17	Soil Grading Layer (Select Fill)	39,000	CY	\$21	\$826,800
18	Geotextile Separation Layer (8-oz/sy)	278,000	SY	\$2.50	\$695,000
19	Gas Venting Layer (Sand)	78,000	CY	\$21	\$1,653,600
20	Passive Gas Vents	40	EA	\$1,100	\$44,000
21	30-mil PVC Liner (or equivalent)	278,000	SY	\$8	\$2,224,000
22	Geotextile Cushion Layer (16-oz/sy)	278,000	SY	\$5	\$1,251,000
23	Soil Protection / Drainage Layer (Sand)	156,000	CY	\$21	\$3,307,200
24	Topsoil Layer	39,000	CY	\$32	\$1,240,200
25	Seed & Mulch	48	AC	\$2,200	\$105,160
Final Cover System:					\$11,389,360
Permanent Stormwater Management					
28	Vegetated Swales	9,500	LF	\$16	\$151,050
29	Riprap-lined Swales	4,000	LF	\$106	\$424,000
30	Riprap Slope Protection	1	LS	\$424,000	\$424,000
31	Culverts	1,000	LF	\$32	\$31,800
32	Subsurface Drain Piping	4,000	LF	\$48	\$190,800
33	Stormwater Basins	3	EA	\$84,800	\$254,400
Permanent Stormwater Management Subtotal:					\$1,476,050
Restoration					
34	As-built Survey	6	WK	\$5,300	\$31,800
35	Backfill	170,000	CY	\$21	\$3,570,000
36	Topsoil	14,000	CY	\$32	\$448,000
37	Seed & Mulch	17	AC	\$2,200	\$37,400
38	Permanent Gravel Access Roads	1	LS	\$265,000	\$265,000
Restoration Subtotal:					\$4,352,200
Post-closure Monitoring Features Installation					
39	Installation of Permanent Gas Monitoring Probes	8	EA	\$5,300	\$42,400
40	Installation of Perimeter Gas Venting Trenches	19,250	SF	\$32	\$616,000
41	Installation of Post-closure Groundwater Monitoring Well Network	24	EA	\$6,400	\$153,600
Post-closure Monitoring Features Installation Subtotal:					\$812,000

TABLE 5-2

Cost Estimate for Remedial Alternative 2A*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
CAPITAL COST SUBTOTAL:					\$27,504,930
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$550,099
Mobilization/Demobilization (5% of Subtotal Capital Cost):					\$1,375,247
Administration, Design, and Construction Oversight:					\$1,500,000
Independent Construction Quality Assurance (10% of Final Cover System Capital Costs):					\$1,138,936
Contingency (20% of Subtotal Capital Cost):					\$5,500,986
TOTAL CAPITAL COST:					\$37,570,197
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
				Discount	
Post-closure Inspections & Maintenance		Annual Cost		Factor	Net Present Value
42	Years 1-5	\$150,000	YR	4.73	\$709,076
43	Years 6-30	\$75,000	YR	17.98	\$1,348,524
Post-closure Inspections & Maintenance Subtotal:					\$2,057,600
Post-closure Landfill Gas Monitoring & Reporting					
44	Years 1-5	\$6,000	YR	4.73	\$28,363
45	Years 6-30	\$3,000	YR	17.98	\$53,941
Post-closure Landfill Gas Monitoring & Reporting Subtotal:					\$82,304
Post-closure Groundwater Sampling & Reporting					
46	Years 1-5	\$250,000	YR	4.73	\$1,181,793
47	Years 6-30	\$125,000	YR	17.98	\$2,247,540
Post-closure Groundwater Sampling & Reporting Subtotal:					\$3,429,333
O&M COST SUBTOTAL:					\$5,569,237
Contingency (20% of Subtotal O&M Cost):					\$1,113,847
TOTAL O&M COST:					\$6,683,084
III. PERIODIC COSTS					
				Discount Rate	1.9%
				Discount	
5-Year Reviews		Annual Cost		Factor	Net Present Value
48	Year 5	\$25,000	YR	0.91	\$22,755
49	Year 10	\$25,000	YR	0.83	\$20,711
50	Year 15	\$25,000	YR	0.75	\$18,851
51	Year 20	\$25,000	YR	0.69	\$17,158
52	Year 25	\$25,000	YR	0.62	\$15,617
53	Year 30	\$25,000	YR	0.57	\$14,214
TOTAL PERIODIC COST:					\$109,304
TOTAL ESTIMATED COST:					\$44,362,586
ROUNDED TO:					\$44,000,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

1. Pre-construction survey includes costs associated with performing an aerial survey, supplemental field survey, in-field property boundary delineations, field marking OU features to be protected (e.g., monitoring wells), and cross sections within Portage Creek prior to construction.
2. Air monitoring unit cost assumes that monitoring activities are required during COC-containing material handling only (e.g., excavation, consolidation, subgrade preparation).

TABLE 5-2

Cost Estimate for Remedial Alternative 2A*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
6.	Clearing and grubbing unit cost is based on cutting and chipping of medium to heavily forested area and grubbing of stumps and other miscellaneous debris within the areas subject to consolidation and final cover system.				
7.	Temporary steel sheeting cost estimate is based on the assumption that approximately 1,200 linear feet of 15-foot-long steel sheeting will be installed to facilitate earthwork activities along the bank of Portage Creek adjacent to the Monarch HRDL.				
12	Soil removal and consolidation quantity represents the total quantity of in-situ material requiring excavation prior to consolidation within the Former Type III Landfill, Western Disposal Area, and Monarch HRDL consolidation areas. Soil removal and consolidation cost includes excavation and loading of COC-containing materials, onsite transport to placement area within the consolidation areas, and placement and compaction in 12-inch lifts within the consolidation areas. Estimated quantities are based on removal and consolidation of approximately 190,000 cubic yards of material along the peripheral areas of the Former Type III Landfill and the Western Disposal Area (including the Panelyte Property, Panelyte Marsh, and Conrail Property), approximately 35,000 cubic yards of material along the peripheral area of the Monarch HRDL, and approximately 99,500 cubic yards of material from outlying areas.				
13	Confirmation sample quantity assumes that all soil removal areas will be sampled on a 50 foot by 50 foot grid to confirm removal of COC-containing material.				
14	Estimated quantity and cost is not based on calculation, rather it is an estimate based on site topography and the potential for sheet pile removal based on slope stability considerations. Lineal footage and costs to be determined during design phase.				
15a	Estimated quantity is based on a setback 30' wide along a linear distance of 2,100 feet along Bryant HRDL/FRDLs and Portage Creek. Estimated excavation depth is 8 feet, based on nearby borings.				
15b	Estimated quantity is based on a setback 30' wide along a linear distance of 1,200 feet along Monarch HRDL and Portage Creek. Estimated excavation depth is an average of 8 feet based on nearby borings.				
16 - 25	Final cover quantities are based on the following estimated areas: Former Type III Landfill - 10 acres, Western Disposal Area - 12 acres, Bryant HRDLs/FRDLs - 20.7 acres, and Monarch HRDL - 5.2 acres.				
17	Soil grading layer cost estimate is based on an assumed 6-inch-thick layer of select fill covering the entire consolidation/cover system areas and is the first layer of the cover system.				
18	Geotextile separation layer cost estimate assumes using a non-woven geotextile covering the entire cover system areas, and includes an additional 20% material quantity to account for overlap and wrinkles. Unit cost is based on information provided by geotextile manufacturer.				
23	Soil protection/drainage layer consists of a 2-foot-thick layer of sand covering the entire cover system area.				
24	Topsoil layer consists of a 6-inch-thick layer of topsoil covering the entire cover system areas.				
25	Seed and mulch cost estimate is based on seeding and mulching the entire area subject to consolidation/final cover system.				
26	Slurry wall costs include all components of design and construction. Groundwater collection and treatment not costed here as the slurry wall cost will be				
28	Total length of the vegetated swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
29	Total length of the riprap-lined swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
31	Total length of culvert piping is based on a conceptual cover system layout prepared for cost estimating purposes only.				
32	It is anticipated that subsurface drainage would be installed at the interface between the consolidation area and the existing Bryant HRDLs and FRDLs liner system. Liner system grades at the interface are assumed to slope downward on a 4 on 1 slope forming a v-notch channel containing the subsurface drainage piping.				
33	Stormwater basin unit cost represents an average per basin cost, which was developed from a conceptual stormwater basin configuration.				
34 - 38	Restoration quantity assumes approximately 17 acres of soil removal area, located outside the limits of capping, as specified in the following: Former Type III Landfill - 3.6 acres, Western Disposal Area - 3.6 acres, Bryant HRDL/RDL - 1.4 acres, Monarch HRDL - 1.6 acres, commercial properties - 5.3 acres and Residential/MHLLC-Owned properties including Golden Age) - 1.5 acres.				
35	Estimated backfill quantities are based on the volume of clean fill material that will be required to backfill the peripheral soil removal areas located outside the limits of capping to appropriate subgrade elevation.				
36	Topsoil quantity is based on covering approximately 17 acres of soil removal area, located outside the limits of capping, with 6 inches of topsoil.				
37	Seed and mulch quantity is based on covering the 17 acres of topsoil placed over the outlying soil removal areas, as necessary to promote vegetative growth.				
38	Permanent access road quantity based on an assumed 8,000 linear feet of newly constructed road that will be required to access various portions of the cover system area for maintenance purposes.				
42 -					
47	Net present value (NPV) factors calculated using the following equation:				

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-3

Cost Estimate for Remedial Alternative 2B*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Site Preparation					
1	Pre-construction Field Survey	1	LS	\$5,000	\$5,000
2	Air Monitoring Program	280	DAY	\$1,500	\$420,000
3	Temporary Fencing	1	LS	\$15,000	\$15,000
4	Decontamination Area	1	EA	\$35,000	\$35,000
5	Temporary Construction Access Roads	1	LS	\$80,000	\$80,000
6	Clearing & Grubbing	20	AC	\$12,000	\$240,000
7	Temporary Steel Sheeting (Drive, Extract and Salvage: Means 31 41 16.10 0100)	282	TON	\$2,100	\$592,200
8	Utility Protection / Relocation	1	LS	\$100,000	\$100,000
9	Temporary Stormwater Management and Erosion and Sediment	1	LS	\$250,000	\$250,000
10	Well Abandonment	18	EA	\$600	\$10,800
Site Preparation Subtotal:					\$1,748,000
Excavation and Consolidation					
11	Survey	10	WK	\$5,300	\$53,000
12	Soil Removal and Consolidation	460000	CY	\$13	\$6,095,000
12a	Construction Water Treatment System	200	days	\$11,000	\$2,200,000
13	Confirmation Sampling	390	EA	\$530	\$206,700
14	Remove Sheet Pile Wall	2600	LF	\$120	\$312,000
15	Soil Removal and Consolidation (setback from creek)	19000	CY	\$13	\$251,750
Excavation and Consolidation Subtotal:					\$9,118,450
Final Cover System					
16	Grade Verification Surveys	8	WK	\$5,300	\$42,400
17	Soil Grading Layer (Select Fill)	34,000	CY	\$21	\$714,000
18	Geotextile Separation Layer (8-oz/sy)	248,000	SY	\$3	\$744,000
19	Gas Venting Layer (Sand)	68,000	CY	\$21	\$1,428,000
20	Passive Gas Vents	30	EA	\$1,100	\$33,000
21	30-mil PVC Liner (or equivalent)	248,000	SY	\$8	\$1,984,000
22	Geotextile Cushion Layer (16-oz/sy)	248,000	SY	\$5	\$1,240,000
23	Soil Protection / Drainage Layer (Sand)	136,000	CY	\$21	\$2,856,000
24	Topsoil Layer	34,000	CY	\$32	\$1,088,000
25	Seed & Mulch	43	AC	\$2,200	\$93,940
Final Cover System Subtotal:					\$10,223,340
Permanent Stormwater Management					
28	Vegetated Swales	8,000	LF	\$16	\$128,000
29	Riprap-lined Swales	3,000	LF	\$110	\$330,000
30	Riprap Slope Protection	1	LS	\$318,000	\$318,000
31	Culverts	800	LF	\$32	\$25,600
32	Subsurface Drain Piping	4,000	LF	\$48	\$192,000
33	Stormwater Basins	2	EA	\$84,800	\$169,600
Permanent Stormwater Management Subtotal:					\$1,163,200
Restoration					
34	As-built Survey	6	WK	\$5,300	\$31,800
35	Backfill	185,000	CY	\$21	\$3,885,000
36	Topsoil	18,000	CY	\$32	\$576,000
37	Seed & Mulch	22.2	AC	\$2,200	\$48,840
38	Permanent Gravel Access Roads	1	LS	\$265,000	\$265,000
Restoration Subtotal:					\$4,806,640
Post-closure Monitoring Features Installation					
39	Installation of Permanent Gas Monitoring Probes	6	EA	\$5,300	\$31,800
40	Installation of Perimeter Gas Venting Trenches	14,500	SF	\$32	\$464,000
41	Installation of Post-closure Groundwater Monitoring Well Network	20	EA	\$6,400	\$128,000
Post-closure Monitoring Features Installation Subtotal:					\$623,800
CAPITAL COST SUBTOTAL:					\$27,683,430

TABLE 5-3

Cost Estimate for Remedial Alternative 2B*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
	Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):				\$553,669
	Mobilization/Demobilization (5% of Subtotal Capital Cost):				\$1,384,172
	Administration, Design, and Construction Oversight:				\$1,500,000
	Independent Construction Quality Assurance (10% of Final Cover System Capital Costs):				\$1,022,334
	Contingency (20% of Subtotal Capital Cost):				\$5,536,686
	TOTAL CAPITAL COST:				\$37,680,290
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
Post-closure Inspections & Maintenance				NPV Factor	NPV
		Current Annual Cost			
42	Years 1-5	\$100,000	YR	4.73	\$472,717
43	Years 6-30	\$50,000	YR	17.98	\$899,016
	Post-closure Inspections & Maintenance Subtotal:				\$1,371,733
Post-closure Landfill Gas Monitoring & Reporting					
44	Years 1-5	\$4,000	YR	4.73	\$18,909
45	Years 6-30	\$2,000	YR	17.98	\$35,961
	Post-closure Landfill Gas Monitoring & Reporting Subtotal:				\$54,869
Post-closure Groundwater Sampling & Reporting					
46	Years 1-5	\$200,000	YR	4.73	\$945,434
47	Years 6-30	\$100,000	YR	17.98	\$1,798,032
	Post-closure Groundwater Sampling & Reporting Subtotal:				\$2,743,466
	O&M COST SUBTOTAL:				\$4,170,069
	Contingency (20% of Subtotal O&M Cost):				\$834,014
	TOTAL O&M COST:				\$5,004,083
III. PERIODIC COSTS					
				Discount Rate	1.9%
5-Year Reviews				Discount Factor	Net Present Value
		Annual Cost			
48	Year 5	\$25,000	YR	0.91	\$22,755
49	Year 10	\$25,000	YR	0.83	\$20,711
50	Year 15	\$25,000	YR	0.75	\$18,851
51	Year 20	\$25,000	YR	0.69	\$17,158
52	Year 25	\$25,000	YR	0.62	\$15,617
53	Year 30	\$25,000	YR	0.57	\$14,214
	TOTAL PERIODIC COST:				\$109,304
	TOTAL ESTIMATED COST:				\$42,793,677
	ROUNDED TO:				\$43,000,000

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc., that is with winter shutdown.

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

- Pre-construction survey includes costs associated with performing an aerial survey, supplemental field survey, in-field property boundary delineations, field marking OU features to be protected (e.g., monitoring wells), and cross sections within Portage Creek prior to construction.
- Air monitoring unit cost assumes that monitoring activities are required during COC-containing material handling only (e.g., excavation, consolidation, subgrade preparation).
- Clearing and grubbing unit cost is based on cutting and chipping of medium to heavily forested area and grubbing of stumps and other miscellaneous debris within the areas subject to consolidation and final cover system.
- Temporary steel sheeting cost estimate is based on the assumption that approximately 1,200 linear feet of 15-foot long steel sheeting will be installed to facilitate earthwork activities along the bank of Portage Creek adjacent to the Monarch HRDL.

TABLE 5-3

Cost Estimate for Remedial Alternative 2B

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
12	Soil removal and consolidation quantity represents the total quantity of in-situ material requiring excavation prior to consolidation within the Former Type III Landfill, Western Disposal Area, and Monarch HRDL consolidation areas. Soil removal and consolidation cost includes excavation and loading of COC-containing materials, onsite transport to placement area within the consolidation areas, and placement and compaction in 12-inch lifts within the consolidation areas. Estimated quantities are based on removal and consolidation of approximately 190,000 cubic yards of material along the peripheral areas of the Former Type III Landfill and the Western Disposal Area (including the Panelyte Property, Panelyte Marsh, and Conrail Property), approximately 170,000 cubic yards from the Monarch HRDL, and approximately 99,500 cubic yards of material from outlying areas.				
13	Confirmation sample quantity assumes that all soil removal areas will be sampled on a 50-foot by 50-foot grid to confirm removal of COC-containing material.				
14	Estimated quantity and cost is not based on calculation, rather it is an estimate based on site topography and the potential for sheet pile removal based on slope stability considerations. Lineal footage and costs to be determined during design phase.				
15	Estimated quantity is based on a setback 30-foot-wide along a linear distance of 2,100 feet along Bryant HRDL/FRDLs and Portage Creek. Estimated excavation depth is 8 feet based on nearby borings.				
16 - 25	Final cover quantities are based on the following estimated areas: Former Type III Landfill - 10 acres, Western Disposal Area - 12 acres, and Bryant HRDLs/FRDLs - 20.7 acres.				
17	Soil grading layer cost estimate is based on an assumed 6-inch-thick layer of select fill covering the entire consolidation/cover system areas and is the first layer of the earthen cover system.				
18	Geotextile separation layer cost estimate assumes utilizing a non-woven geotextile covering the entire cover system areas, and includes an additional 20% material quantity to account for overlap and wrinkles. Unit cost is based on information provided by geotextile manufacturer.				
23	Soil protection/drainage layer consists of a 2-foot-thick layer of sand covering the entire cover system area.				
24	Topsoil layer consists of a 6-inch-thick layer of topsoil covering the entire cover system areas.				
25	Seed and mulch cost estimate is based on seeding and mulching the entire area subject to consolidation/final cover system.				
26	Slurry wall costs include all components of design and construction. Groundwater collection and treatment (Contingency 2) not costed here as the slurry wall cost will be higher.				
28	Total length of the vegetated swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
29	Total length of the riprap-lined swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
31	Total length of culvert piping is based on a conceptual cover system layout prepared for cost estimating purposes only.				
32	It is anticipated that subsurface drainage would be installed at the interface between the consolidation area and the existing Bryant HRDLs and FRDLs liner system. Liner system grades at the interface are assumed to slope downward on a 4 on 1 slope forming a v-notch channel containing the subsurface drainage piping.				
33	Stormwater basin unit cost represents an average per basin cost, which was developed from a conceptual stormwater basin configuration.				
34 - 38	Restoration quantity assumes approximately 22 acres of soil removal area, located outside the limits of capping, as specified in the following: Former Type III Landfill - 3.6 acres, Western Disposal Area - 3.6 acres, Bryant HRDL/RDL - 1.4 acres, Monarch HRDL - 6.8 acres, commercial properties - 5.3 acres and Residential/MHLLC-Owned properties including Golden Age) - 1.5 acres.				
35	Estimated backfill quantities are based on the volume of clean fill material that will be required to backfill the peripheral soil removal areas located outside the limits of capping to appropriate subgrade elevation. An estimated 50,000 cubic yards will be used to backfill the Monarch HRDL. Actual quantities will be determined during the design.				
36	Topsoil quantity is based on covering approximately 22 acres of soil removal area, located outside the limits of capping, with 6 inches of topsoil.				
37	Seed and mulch quantity is based on covering the 22 acres of topsoil placed over the outlying soil removal areas, as necessary to promote vegetative growth.				
38	Permanent access road quantity based on an assumed 8,000 linear feet of newly constructed road that will be required to access various portions of the cover system area for maintenance purposes.				
42 - 47	Net present value (NPV) factors calculated using the following equation:				

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-4

Cost Estimate for Remedial Alternative 2C*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Site Preparation					
1	Pre-construction Field Survey	1	LS	\$5,300	\$5,300
2	Air Monitoring Program	280	DAY	\$1,600	\$448,000
3	Temporary Fencing	1	LS	\$16,000	\$16,000
4	Decontamination Area	1	EA	\$37,000	\$37,000
5	Temporary Construction Access Roads	1	LS	\$85,000	\$85,000
6	Clearing & Grubbing	20	AC	\$13,000	\$260,000
7	Temporary Steel Sheeting (Drive, Extract and Salvage: Means 31 41 16.10 0100)	282	TON	\$2,200	\$620,400
8	Utility Protection / Relocation	1	LS	\$106,000	\$106,000
9	Temporary Stormwater Management and Erosion and Sediment	1	LS	\$265,000	\$265,000
10	Well Abandonment	18	EA	\$640	\$11,520
Site Preparation Subtotal:					\$1,854,220
Excavation and Consolidation					
11	Survey	10	WK	\$5,300	\$53,000
12	Soil Removal and Consolidation	445,000	CY	\$13	\$5,896,250
12a	Construction Water Treatment System	200	days	\$11,000	\$2,200,000
13	Confirmation Sampling	390	EA	\$530	\$206,700
14	Remove Sheet Pile Wall	2,600	LF	\$120	\$312,000
14a	Soil Removal and Consolidation (setback from creek)	19,000	CY	\$13	\$251,750
Excavation and Consolidation Subtotal:					\$8,919,700
Excavation, Transportation, and Incineration of > 500 mg/kg material					
15	Additional Hot Spot Investigation	1	LS	\$53,000	\$53,000
15a	Excavation	15,000	CY	\$13	\$195,000
15b	Transportation & Disposal	24,250	tons	\$873	\$21,170,250
Excavation, Transportation, and Incineration Subtotal:					\$21,418,250
Final Cover System					
16	Grade Verification Surveys	8	WK	\$5,300	\$42,400
17	Soil Grading Layer (Select Fill)	34,000	CY	\$21	\$714,000
18	Geotextile Separation Layer (8-oz/sy)	248,000	SY	\$3	\$744,000
19	Gas Venting Layer (Sand)	68,000	CY	\$21	\$1,428,000
20	Passive Gas Vents	30	EA	\$1,100	\$33,000
21	30-mil PVC Liner (or equivalent)	248,000	SY	\$8	\$1,984,000
22	Geotextile Cushion Layer (16-oz/sy)	248,000	SY	\$5	\$1,240,000
23	Soil Protection / Drainage Layer (Sand)	136,000	CY	\$21	\$2,856,000
24	Topsoil Layer	34,000	CY	\$32	\$1,088,000
25	Seed & Mulch	43	AC	\$2,200	\$93,940
Final Cover System Subtotal:					\$10,223,340
Permanent Stormwater Management					
28	Vegetated Swales	8,000	LF	\$16	\$128,000
29	Riprap-lined Swales	3,000	LF	\$110	\$330,000
30	Riprap Slope Protection	1	LS	\$318,000	\$318,000
31	Culverts	800	LF	\$32	\$25,600
32	Subsurface Drain Piping	4,000	LF	\$48	\$192,000
33	Stormwater Basins	2	EA	\$84,800	\$169,600
Permanent Stormwater Management Subtotal:					\$1,163,200
Restoration					
34	As-built Survey	6	WK	\$5,300	\$31,800
35	Backfill	185,000	CY	\$21	\$3,885,000
36	Topsoil	18,000	CY	\$32	\$576,000
37	Seed & Mulch	22.2	AC	\$2,200	\$48,840
38	Permanent Gravel Access Roads	1	LS	\$265,000	\$265,000
Restoration Subtotal:					\$4,806,640
Post-closure Monitoring Features Installation					
39	Installation of Permanent Gas Monitoring Probes	6	EA	\$5,300	\$31,800

TABLE 5-4

Cost Estimate for Remedial Alternative 2C*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
40	Installation of Perimeter Gas Venting Trenches	14,500	LF	\$32	\$464,000
41	Installation of Post-closure Groundwater Monitoring Well Network	20	EA	\$6,400	\$128,000
Post-closure Monitoring Features Installation Subtotal:					\$623,800
CAPITAL COST SUBTOTAL:					\$49,009,150
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$980,183
Mobilization/Demobilization:					\$1,500,000
Administration, Design, and Construction Oversight:					\$2,500,000
Independent Construction Quality Assurance (10% of Final Cover System Capital Costs):					\$1,022,334
Contingency (20% of Subtotal Capital Cost):					\$9,801,830
TOTAL CAPITAL COST:					\$64,813,497
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
Post-closure Inspections & Maintenance		Current Annual Cost		NPV Factor	NPV
42	Years 1-5	\$100,000	YR	4.73	\$472,717
43	Years 6-30	\$50,000	YR	17.98	\$899,016
Post-closure Inspections & Maintenance Subtotal:					\$1,371,733
Post-closure Landfill Gas Monitoring & Reporting					
44	Years 1-5	\$4,000	YR	4.73	\$18,909
45	Years 6-30	\$2,000	YR	17.98	\$35,961
Post-closure Landfill Gas Monitoring & Reporting Subtotal:					\$54,869
Post-closure Groundwater Sampling & Reporting					
46	Years 1-5	\$200,000	YR	4.73	\$945,434
47	Years 6-30	\$100,000	YR	17.98	\$1,798,032
Post-closure Groundwater Sampling & Reporting Subtotal:					\$2,743,466
O&M COST SUBTOTAL:					\$4,170,069
Contingency (20% of Subtotal O&M Cost):					\$834,014
TOTAL O&M COST:					\$5,004,083
III. PERIODIC COSTS					
				Discount Rate	1.9%
5-Year Reviews		Annual Cost		Discount Factor	Net Present Value
48	Year 5	\$25,000	YR	0.91	\$22,755
49	Year 10	\$25,000	YR	0.83	\$20,711
50	Year 15	\$25,000	YR	0.75	\$18,851
51	Year 20	\$25,000	YR	0.69	\$17,158
52	Year 25	\$25,000	YR	0.62	\$15,617
53	Year 30	\$25,000	YR	0.57	\$14,214
TOTAL PERIODIC COST:					\$109,304
TOTAL ESTIMATED COST:					\$69,926,884
ROUNDED TO:					\$70,000,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

TABLE 5-4

Cost Estimate for Remedial Alternative 2C*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
Item Notes (where applicable):					
1.	Pre-construction survey includes costs associated with performing an aerial survey, supplemental field survey, in-field property boundary delineations, field marking OU features to be protected (e.g., monitoring wells), and cross sections within Portage Creek prior to construction.				
2.	Air monitoring unit cost assumes that monitoring activities are required during COC-containing material handling only (e.g., excavation, consolidation, subgrade preparation).				
6.	Clearing and grubbing unit cost is based on cutting and chipping of medium to heavily forested area and grubbing of stumps and other miscellaneous debris within the areas subject to consolidation and final cover system.				
7.	Temporary steel sheeting cost estimate is based on the assumption that approximately 1,200 linear feet of 15-foot long steel sheeting will be installed to facilitate earthwork activities along the bank of Portage Creek adjacent to the Monarch HRDL.				
12	Soil removal and consolidation quantity represents the total quantity of in-situ material requiring excavation prior to consolidation within the Former Type III Landfill, Western Disposal Area, and Monarch HRDL consolidation areas. Soil removal and consolidation cost includes excavation and loading of COC-containing materials, onsite transport to placement area within the consolidation areas, and placement and compaction in 12-inch lifts within the consolidation areas.				
13	Confirmation sample quantity assumes that all soil removal areas will be sampled on a 50 foot by 50 foot grid to confirm removal of COC-containing material.				
14	Estimated quantity and cost is not based on calculation, rather it is an estimate based on site topography and the potential for sheet pile removal based on slope stability considerations. Lineal footage and costs to be determined during design phase.				
14a	Estimated quantity is based on a setback 30' wide along a linear distance of 2100 feet along Bryant HRDL/FRDLs and Portage Creek. Estimated excavation depth is 8 feet based on nearby borings.				
15	Estimated quantity of material above > 500 mg/kg taken from percentages presented in FIELDS analysis. Transportation and Disposal cost based on previous quotes from facilities that can handle this material. Added \$25/ton to account for staging/stockpile maintenance due to limited amount of material that can be processed at incinerator.				
16 - 25	Final cover quantities are based on the following estimated areas: Former Type III Landfill - 10 acres, Western Disposal Area - 12 acres, and Bryant HRDLs/FRDLs - 20.7 acres.				
17	Soil grading layer cost estimate is based on an assumed 6-inch-thick layer of select fill covering the entire consolidation/cover system areas and is the first layer of the earthen cover system.				
18	Geotextile separation layer cost estimate assumes using a non-woven geotextile covering the entire cover system areas, and includes an additional 20% material quantity to account for overlap and wrinkles. Unit cost is based on information provided by geotextile manufacturer.				
23	Soil protection/drainage layer consists of a 2-foot-thick layer of sand covering the entire cover system area.				
24	Topsoil layer consists of a 6-inch-thick layer of topsoil covering the entire cover system areas.				
25	Seed and mulch cost estimate is based on seeding and mulching the entire area subject to consolidation/final cover system.				
26	Slurry wall costs include all components of design and construction. Groundwater collection and treatment (Contingency 2) not costed here as the slurry wall cost will be higher.				
28	Total length of the vegetated swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
29	Total length of the riprap-lined swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
31	Total length of culvert piping is based on a conceptual cover system layout prepared for cost estimating purposes only.				
32	It is anticipated that subsurface drainage would be installed at the interface between the consolidation area and the existing Bryant HRDLs and FRDLs liner system. Liner system grades at the interface are assumed to slope downward on a 4 on 1 slope forming a v-notch channel containing the subsurface drainage piping.				
33	Stormwater basin unit cost represents an average per basin cost, which was developed from a conceptual stormwater basin configuration.				
34 - 38	Restoration quantity assumes approximately 22 acres of soil removal area, located outside the limits of capping, as specified in the following: Former Type III Landfill - 3.6 acres, Western Disposal Area - 3.6 acres, Bryant HRDL/RDL - 1.4 acres, Monarch HRDL - 6.8 acres, commercial properties - 5.3 acres and Residential/MHLLC-Owned properties including Golden Age) - 1.5 acres.				
35	Estimated backfill quantities are based on the volume of clean fill material that will be required to backfill the peripheral soil removal areas located outside the limits of capping to appropriate subgrade elevation. An estimated 50,000 cubic yards will be used to backfill the Monarch HRDL. Actual quantities will be determined during the design.				
36	Topsoil quantity is based on covering approximately 22 acres of soil removal area, located outside the limits of capping, with 6 inches of topsoil.				
37	Seed and mulch quantity is based on covering the 22 acres of topsoil placed over the outlying soil removal areas, as necessary to promote vegetative growth.				
38	Permanent access road quantity based on an assumed 8,000 linear feet of newly constructed road that will be required to access various portions of the cover system area for maintenance purposes.				
42 - 47	Net present value (NPV) factors calculated using the following equation:				

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-5

Cost Estimate for Remedial Alternative 2D*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Site Preparation					
1	Pre-construction Field Survey	1	LS	\$5,300	\$5,300
2	Air Monitoring Program	420	DAY	\$1,600	\$672,000
3	Temporary Fencing	1	LS	\$16,000	\$16,000
4	Decontamination Area	1	EA	\$37,000	\$37,000
5	Temporary Construction Access Roads	1	LS	\$85,000	\$85,000
6	Clearing & Grubbing	20	AC	\$13,000	\$260,000
7	Temporary Steel Sheeting (Drive, Extract and Salvage: Means 31 41 16.10 0100)	564	TON	\$2,200	\$1,240,800
8	Utility Protection / Relocation	1	LS	\$106,000	\$106,000
9	Temporary Stormwater Management and Erosion and Sediment	1	LS	\$265,000	\$265,000
10	Well Abandonment	100	EA	\$640	\$64,000
Site Preparation Subtotal:					\$2,751,100
Excavation and Consolidation					
11	Survey	10	WK	\$5,300	\$53,000
12	Soil Removal and Consolidation	920000	CY	\$13	\$12,190,000
12a	Construction Water Treatment System	300	days	\$11,000	\$3,300,000
13	Confirmation Sampling	660	EA	\$530	\$349,800
14	Remove Sheet Pile Wall	2600	LF	\$120	\$312,000
15	Soil Removal and Consolidation (setback from creek)	0	CY	\$13	\$0
Excavation and Consolidation Subtotal:					\$16,204,800
Final Cover System					
16	Grade Verification Surveys	8	WK	\$5,000	\$40,000
17	Soil Grading Layer (Select Fill)	22,900	CY	\$20	\$458,000
18	Geotextile Separation Layer (8-oz/sy)	10,000	SY	\$3	\$25,000
19	Gas Venting Layer (Sand)	44,000	CY	\$21	\$924,000
20	Active Gas Venting System	28	EA	\$95,000	\$2,696,901
21	30-mil PVC Liner (or equivalent)	160,000	SY	\$8	\$1,280,000
22	Geotextile Cushion Layer (16-oz/sy)	160,000	SY	\$5	\$800,000
23	Soil Protection / Drainage Layer (Sand)	91,000	CY	\$21	\$1,911,000
24	Topsoil Layer	22,900	CY	\$32	\$732,800
25	Seed & Mulch	28	AC	\$2,200	\$62,455
Final Cover System Subtotal:					\$8,930,155
Permanent Stormwater Management					
28	Vegetated Swales	16,000	LF	\$16	\$256,000
29	Riprap-lined Swales	6,000	LF	\$110	\$660,000
30	Riprap Slope Protection	1	LS	\$636,000	\$636,000
31	Culverts	1,600	LF	\$32	\$51,200
32	Subsurface Drain Piping	8,000	LF	\$48	\$384,000
33	Stormwater Basins	2	EA	\$84,800	\$169,600
Permanent Stormwater Management Subtotal:					\$2,156,800
Restoration					
34	As-built Survey	6	WK	\$5,300	\$31,800
35	Backfill	400,000	CY	\$21	\$8,400,000
36	Topsoil	31,000	CY	\$32	\$992,000
37	Seed & Mulch	38	AC	\$2,200	\$83,600
38	Permanent Gravel Access Roads	1	LS	\$265,000	\$265,000
Restoration Subtotal:					\$9,772,400
Post-closure Monitoring Features Installation					
39	Installation of Permanent Gas Monitoring Probes	0	EA	\$5,300	\$0
40	Installation of Perimeter Gas Venting Trenches	0	SF	\$21	\$0
41	Installation of Post-closure Groundwater Monitoring Well Network	20	EA	\$6,400	\$128,000
Post-closure Monitoring Features Installation Subtotal:					\$128,000
CAPITAL COST SUBTOTAL:					\$39,943,255

TABLE 5-5

Cost Estimate for Remedial Alternative 2D*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
	Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):				\$798,865
	Mobilization/Demobilization (5% of Subtotal Capital Cost):				\$1,997,163
	Administration, Design, and Construction Oversight:				\$5,000,000
	Independent Construction Quality Assurance (10% of Final Cover System Capital Costs):				\$893,016
	Contingency (20% of Subtotal Capital Cost):				\$7,988,651
	TOTAL CAPITAL COST:				\$56,620,950
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
Post-closure Inspections & Maintenance				NPV Factor	NPV
42	Years 1-5	\$150,000	YR	4.73	\$709,076
43	Years 6-30	\$75,000	YR	17.98	\$1,348,524
	Post-closure Inspections & Maintenance Subtotal:				\$2,057,600
Post-closure Landfill Gas Monitoring & Reporting					
44	Years 1-5	\$4,000	YR	4.73	\$18,909
45	Years 6-30	\$2,000	YR	17.98	\$35,961
	Post-closure Landfill Gas Monitoring & Reporting Subtotal:				\$54,869
Post-closure Groundwater Sampling & Reporting					
46	Years 1-5	\$200,000	YR	4.73	\$945,434
47	Years 6-30	\$100,000	YR	17.98	\$1,798,032
	Post-closure Groundwater Sampling & Reporting Subtotal:				\$2,743,466
	O&M COST SUBTOTAL:				\$4,855,936
	Contingency (20% of Subtotal O&M Cost):				\$971,187
	TOTAL O&M COST:				\$5,827,123
III. PERIODIC COSTS					
				Discount Rate	1.9%
5-Year Reviews				Discount Factor	Net Present Value
48	Year 5	\$25,000	YR	0.91	\$22,755
49	Year 10	\$25,000	YR	0.83	\$20,711
50	Year 15	\$25,000	YR	0.75	\$18,851
51	Year 20	\$25,000	YR	0.69	\$17,158
52	Year 25	\$25,000	YR	0.62	\$15,617
53	Year 30	\$25,000	YR	0.57	\$14,214
	TOTAL PERIODIC COST:				\$109,304
	TOTAL ESTIMATED COST:				\$62,557,377
	ROUNDED TO:				\$63,000,000

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc., that is with winter shutdown.

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

1. Pre-construction survey includes costs associated with performing an aerial survey, supplemental field survey, in-field property boundary delineations, field marking OU features to be protected (e.g., monitoring wells), and cross sections within Portage Creek prior to construction.
2. Air monitoring unit cost assumes that monitoring activities are required during COC-containing material handling only (e.g., excavation, consolidation, subgrade preparation).
6. Clearing and grubbing unit cost is based on cutting and chipping of medium to heavily forested area and grubbing of stumps and other miscellaneous debris within the areas subject to consolidation and final cover system.
7. Temporary steel sheeting cost estimate is based on the assumption that approximately 1,200 linear feet of 15-foot long steel sheeting will be installed to facilitate earthwork activities along the bank of Portage Creek adjacent to the Monarch HRDL.

TABLE 5-5

Cost Estimate for Remedial Alternative 2D

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
12	Soil removal and consolidation quantity represents the total quantity of in-situ material requiring excavation prior to consolidation within the Former Type III Landfill, Western Disposal Area, and Monarch HRDL consolidation areas. Soil removal and consolidation cost includes excavation and loading of COC-containing materials, onsite transport to placement area within the consolidation areas, and placement and compaction in 12-inch lifts within the consolidation areas. Estimated quantities are based on removal and consolidation of approximately 190,000 cubic yards of material along the peripheral areas of the Former Type III Landfill and the Western Disposal Area (including the Panelyte Property, Panelyte Marsh, and Conrail Property), approximately 170,000 cubic yards from the Monarch HRDL, and approximately 99,500 cubic yards of material from outlying areas.				
13	Confirmation sample quantity assumes that all soil removal areas will be sampled on a 50-foot by 50-foot grid to confirm removal of COC-containing material.				
14	Estimated quantity and cost is not based on calculation, rather it is an estimate based on site topography and the potential for sheet pile removal based on slope stability considerations. Lineal footage and costs to be determined during design phase.				
15	Estimated quantity is based on a setback 30-foot-wide along a linear distance of 2,100 feet along Bryant HRDL/FRDLs and Portage Creek. Estimated excavation depth is 8 feet based on nearby borings.				
16 - 25	Final cover quantities are based on the following estimated areas: Former Type III Landfill - 10 acres, Western Disposal Area - 12 acres, and Bryant HRDLs/FRDLs - 20.7 acres.				
17	Soil grading layer cost estimate is based on an assumed 6-inch-thick layer of select fill covering the entire consolidation/cover system areas and is the first layer of the earthen cover system.				
18	Geotextile separation layer cost estimate assumes utilizing a non-woven geotextile covering the entire cover system areas, and includes an additional 20% material quantity to account for overlap and wrinkles. Unit cost is based on information provided by geotextile manufacturer.				
23	Soil protection/drainage layer consists of a 2-foot-thick layer of sand covering the entire cover system area.				
24	Topsoil layer consists of a 6-inch-thick layer of topsoil covering the entire cover system areas.				
25	Seed and mulch cost estimate is based on seeding and mulching the entire area subject to consolidation/final cover system.				
26	Slurry wall costs include all components of design and construction. Groundwater collection and treatment (Contingency 2) not costed here as the slurry wall cost will be higher.				
28	Total length of the vegetated swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
29	Total length of the riprap-lined swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
31	Total length of culvert piping is based on a conceptual cover system layout prepared for cost estimating purposes only.				
32	It is anticipated that subsurface drainage would be installed at the interface between the consolidation area and the existing Bryant HRDLs and FRDLs liner system. Liner system grades at the interface are assumed to slope downward on a 4 on 1 slope forming a v-notch channel containing the subsurface drainage piping.				
33	Stormwater basin unit cost represents an average per basin cost, which was developed from a conceptual stormwater basin configuration.				
34 - 38	Restoration quantity assumes approximately 22 acres of soil removal area, located outside the limits of capping, as specified in the following: Former Type III Landfill - 3.6 acres, Western Disposal Area - 3.6 acres, Bryant HRDL/RDL - 1.4 acres, Monarch HRDL - 6.8 acres, commercial properties - 5.3 acres and Residential/MHLLC-Owned properties including Golden Age) - 1.5 acres.				
35	Estimated backfill quantities are based on the volume of clean fill material that will be required to backfill the peripheral soil removal areas located outside the limits of capping to appropriate subgrade elevation. An estimated 50,000 cubic yards will be used to backfill the Monarch HRDL. Actual quantities will be determined during the design.				
36	Topsoil quantity is based on covering approximately 42 acres of soil removal area, located outside the limits of capping, with 6 inches of topsoil.				
37	Seed and mulch quantity is based on covering the 42 acres of topsoil placed over the outlying soil removal areas, as necessary to promote vegetative growth.				
38	Permanent access road quantity based on an assumed 8,000 linear feet of newly constructed road that will be required to access various portions of the cover system area for maintenance purposes.				
42 - 47	Net present value (NPV) factors calculated using the following equation:				

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-6

Cost Estimate for Remedial Alternative 2A Groundwater Subalternative (i)

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Groundwater Collection Trench					
1	Pre-construction Field Survey	1	LS	\$26,500	\$26,500
2	Work Planning	1	LS	\$159,000	\$159,000
3	Design	1	LS	\$63,600	\$63,600
4	GW Collection Trench & Backfill	67,500	SF	\$5.80	\$391,500
5	Spoils Consolidated in Landfill	12,500	CY	\$5.30	\$66,250
6	GW Transfer Piping and Appurtenances	1	LS	\$424,000	\$424,000
7	GW System Start Up	1	LS	\$79,500	\$79,500
Post-closure Monitoring Features Installation Subtotal:					\$1,210,350
CAPITAL COST SUBTOTAL:					\$1,210,350
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$24,207
Mobilization/Demobilization (5% of Subtotal Capital Cost):					\$60,518
Administration and Construction Oversight(10% of Subtotal Capital Cost):					\$121,035
Contingency (20% of Subtotal Capital Cost):					\$242,070
TOTAL CAPITAL COST:					\$1,658,180
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
Groundwater Treatment		Current Annual Cost	NPV Factor	NPV	
8	Years 1-5	\$100,000	YR	4.73	\$472,717
9	Years 6-30	\$100,000	YR	17.98	\$1,798,032
Groundwater Treatment					\$2,270,749
O&M COST SUBTOTAL:					\$2,270,749
Contingency (20% of Subtotal O&M Cost):					\$454,150
TOTAL O&M COST:					\$2,724,899
TOTAL ESTIMATED COST:					\$4,383,079
ROUNDED TO:					\$4,400,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2013 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SF = Square Foot; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

- 3 Design includes evaluation of current O&M system and components for use with the proposed system. For this alternative, design costs are specifically included in the cost instead of as a percentage of the construction costs.
- 4 Groundwater collection trench costs based on similar project experience; square footage based on an approximate estimate.
- 5 Piping, lift stations, and extraction well costs based on similar project costs.
- 6 System start up costs based on ten days of prove-out; based on previous project experience.
- 8 - 9 Net present value (NPV) factors calculated using the following equation:

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-7

Cost Estimate for Remedial Alternatives 2B, 2C & 2D Groundwater Subalternative (i)

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Groundwater Collection and Treatment					
Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Groundwater Collection Trench					
1	Pre-construction Field Survey	1	LS	\$26,500	\$26,500
2	Work Planning	1	LS	\$159,000	\$159,000
3	Design	1	LS	\$63,600	\$63,600
4	GW Collection Trench & Backfill	55,000	SF	\$5.80	\$319,000
5	Spoils Consolidated in Landfill	10,278	CY	\$5.30	\$54,472
6	GW Transfer Piping and Appurtenances	1	LS	\$424,000	\$424,000
7	GW System Start Up	1	LS	\$79,500	\$79,500
Post-closure Monitoring Features Installation Subtotal:					\$1,126,072
CAPITAL COST SUBTOTAL:					\$1,126,072
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$22,521.44
Mobilization/Demobilization (5% of Subtotal Capital Cost):					\$56,304
Administration and Construction Oversight(10% of Subtotal Capital Cost):					\$112,607
Contingency (20% of Subtotal Capital Cost):					\$225,214
TOTAL CAPITAL COST:					\$1,542,719
II. OPERATION AND MAINTENANCE (O&M) COSTS					
Groundwater Treatment		Current Annual Cost	Discount Rate	1.9%	
			NPV Factor	NPV	
8	Years 1-5	\$100,000	YR	4.73	\$472,717
9	Years 6-30	\$100,000	YR	17.98	\$1,798,032
Groundwater Treatment					\$2,270,749
O&M COST SUBTOTAL:					\$2,270,749
Contingency (20% of Subtotal O&M Cost):					\$454,150
TOTAL O&M COST:					\$2,724,899
TOTAL ESTIMATED COST:					\$4,267,618
ROUNDED TO:					\$4,300,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2013 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

- 3 Design includes evaluation of current O&M system and components for use with the proposed system. For this alternative, design costs are specifically included in the cost instead of as a percentage of the construction costs.
- 4 Groundwater collection trench costs based on similar project experience; square footage based on an approximate estimate.
- 5 Piping, lift stations, and extraction well costs based on similar project costs.
- 6 System start up costs based on ten days of prove-out; based on previous project experience.
- 8 - 9 Net present value (NPV) factors calculated using the following equation:

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-8

Cost Estimate for Remedial Alternative 2A Groundwater Subalternative (ii)

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Slurry Wall and Hydraulic Control					
Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Groundwater Collection Trench					
1	Pre-construction Field Survey	1	LS	\$26,500	\$26,500
2	Work Planning	1	LS	\$159,000	\$159,000
3	Design	1	LS	\$63,600	\$63,600
4	GW Collection Trench & Backfill	67,500	SF	\$5.80	\$391,500
5	Spoils Consolidated in Landfill	12,500	CY	\$5.30	\$66,250
6	GW Transfer Piping and Appurtenances	1	LS	\$424,000	\$424,000
7	GW System Start Up	1	LS	\$79,500	\$79,500
Post-closure Monitoring Features Installation Subtotal:					\$1,210,350
Slurry Wall					
8	Installation of Slurry Wall	270,000	SF	\$17.40	\$4,698,000
9	Spoils Consolidated in Landfill	400,000	CY	\$5.30	\$2,120,000
Slurry Wall Subtotal					\$6,818,000
CAPITAL COST SUBTOTAL:					\$8,028,350
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$160,567
Mobilization/Demobilization (5% of Subtotal Capital Cost):					\$401,418
Administration and Construction Oversight(10% of Subtotal Capital Cost):					\$802,835
Contingency (20% of Subtotal Capital Cost):					\$1,605,670
TOTAL CAPITAL COST:					\$10,998,840
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
Groundwater Treatment		Current Annual Cost		NPV Factor	NPV
9	Years 1-5	\$100,000	YR	4.73	\$472,717
10	Years 6-30	\$100,000	YR	17.98	\$1,798,032
Groundwater Treatment					\$2,270,749
O&M COST SUBTOTAL:					\$2,270,749
Contingency (20% of Subtotal O&M Cost):					\$454,150
TOTAL O&M COST:					\$2,724,899
TOTAL ESTIMATED COST:					\$13,723,739
ROUNDED TO:					\$14,000,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the Unit prices are based on 2013 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

- 3 Design includes evaluation of current O&M system and components for use with the proposed system. For this alternative, design costs are specifically
- 4 Groundwater collection trench costs based on similar project experience; square footage based on an approximate estimate.
- 5 Piping, lift stations, and extraction well costs based on similar project costs.
- 6 System start up costs based on ten days of prove-out; based on previous project experience.
- 7 Slurry wall costs presented on a square foot basis; include design, site restoration, and other ancillary activities. Costs based on project experience.
- 8 - 9 Net present value (NPV) factors calculated using the following equation:

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-9

Cost Estimate for Remedial Alternatives 2B & 2C Groundwater Subalternative (ii)

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Slurry Wall and Hydraulic Control					
Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Groundwater Collection Trench					
1	Pre-construction Field Survey	1	LS	\$26,500	\$26,500
2	Work Planning	1	LS	\$159,000	\$159,000
3	Design	1	LS	\$63,600	\$63,600
4	GW Collection Trench & Backfill	55,000	SF	\$5.80	\$319,000
5	Spoils Consolidated in Landfill	10,278	CY	\$5.30	\$54,472
6	GW Transfer Piping and Appurtenances	1	LS	\$424,000	\$424,000
7	GW System Start Up	1	LS	\$79,500	\$79,500
Post-closure Monitoring Features Installation Subtotal:					\$1,126,072
Slurry Wall					
8	Installation of Slurry Wall	220,000	SF	\$17.40	\$3,828,000
9	Spoils Consolidated in Landfill	325,925.9	CY	\$5.30	\$1,727,407
Contingent Groundwater Subtotal:					\$5,555,407
CAPITAL COST SUBTOTAL:					\$6,681,480
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$133,630
Mobilization/Demobilization (5% of Subtotal Capital Cost):					\$334,074
Administration and Construction Oversight(10% of Subtotal Capital Cost):					\$668,148
Contingency (20% of Subtotal Capital Cost):					\$1,336,296
TOTAL CAPITAL COST:					\$9,153,627
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
Groundwater Treatment		Current Annual Cost	NPV Factor		NPV
10	Years 1-5	\$100,000	YR	4.73	\$472,717
11	Years 6-30	\$100,000	YR	17.98	\$1,798,032
Groundwater Treatment					\$2,270,749
O&M COST SUBTOTAL:					\$2,270,749
Contingency (20% of Subtotal O&M Cost):					\$454,150
TOTAL O&M COST:					\$2,724,899
TOTAL ESTIMATED COST:					\$11,878,526
ROUNDED TO:					\$12,000,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the Unit prices are based on 2013 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

- 3 Design includes evaluation of current O&M system and components for use with the proposed system. For this alternative, design costs are specifically included in the cost instead of as a percentage of the construction costs.
- 4 Groundwater collection trench costs based on similar project experience; square footage based on an approximate estimate.
- 5 Piping, lift stations, and extraction well costs based on similar project costs.
- 6 System start up costs based on ten days of prove-out; based on previous project experience.
- 7 Slurry wall costs presented on a square foot basis; include design, site restoration, and other ancillary activities. Costs based on project experience.
- 8 - 9 Net present value (NPV) factors calculated using the following equation:

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

TABLE 5-10

Cost Estimate for Remedial Alternative 3*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Site Preparation					
1	Pre-construction Field Survey	1	LS	\$10,400	\$10,400
2	Air Monitoring Program	700	DAY	\$1,600	\$1,120,000
3	Temporary Fencing	1	LS	\$15,900	\$15,900
4	Decontamination Area	1	EA	\$37,100	\$37,100
5	Temporary Construction Access Roads	1	LS	\$84,800	\$84,800
6	Clearing & Grubbing	20	AC	\$13,000	\$260,000
7	Temporary Steel Sheeting (Drive, Extract and Salvage: Means 31 41 16.10 0100)	282	TON	\$2,200	\$620,400
8	Utility Protection / Relocation	1	LS	\$106,000	\$106,000
9	Temporary Stormwater Management and Erosion and Sediment	1	LS	\$265,000	\$265,000
10	Well Abandonment	18	EA	\$640	\$11,520
Site Preparation Subtotal:					\$2,531,120
Excavation					
11	Survey	60	WK	\$5,300	\$318,000
12	Removal & Segregation of Clean Soil Cover from Bryant HRDL/FRDLs	90,000	CY	\$5	\$450,000
13	Soil Removal & Processing/Loading into Disposal Containers	1,600,000	CY	\$7	\$10,400,000
13a	Construction Water Treatment System	400	days	\$10,600	\$4,240,000
13b	Backfill of Excavation	807,500	CY	\$21	\$16,957,500
14	Remove Sheet Pile	2,600	LF	\$110	\$286,000
15	Confirmation Sampling	1,130	EA	\$530	\$598,900
Excavation and Consolidation Subtotal:					\$33,250,400
Offsite Transportation & Disposal					
16	Offsite Transportation & Disposal - TSCA	800,000	TN	\$100	\$80,000,000
17	Offsite Transportation & Disposal - Non-TSCA	1,800,000	TN	\$40	\$72,000,000
Offsite Disposal Subtotal:					\$152,000,000
Restoration					
18	As-built Survey	6	WK	\$5,300	\$31,800
19	Topsoil	52,000	CY	\$32	\$1,664,000
20	Seed & Mulch	65	AC	\$2,200	\$143,000
Restoration Subtotal:					\$1,838,800
CAPITAL COST SUBTOTAL:					\$189,620,320
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$3,792,406
Mobilization/Demobilization (capped at \$1.5 million):					\$1,500,000
Administration, Design, and Construction Oversight (\$1 million a year):					\$5,000,000
Contingency (20% of Subtotal Capital Cost):					\$37,924,064
TOTAL CAPITAL COST:					\$237,836,790
III. PERIODIC COSTS					
				Discount Rate	1.9%
				Discount	
5-Year Reviews		Annual Cost	Factor	Net Present Value	
22	Year 5	\$25,000	YR	0.91	\$22,755
23	Year 10	\$25,000	YR	0.83	\$20,711
24	Year 15	\$25,000	YR	0.75	\$18,851
25	Year 20	\$25,000	YR	0.69	\$17,158
26	Year 25	\$25,000	YR	0.62	\$15,617
27	Year 30	\$25,000	YR	0.57	\$14,214
TOTAL PERIODIC COST:					\$109,304
TOTAL ESTIMATED COST:					\$237,946,095
ROUNDED TO:					\$238,000,000

TABLE 5-10

Cost Estimate for Remedial Alternative 3

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to Unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton; WK = Week; MO = Month.

Item Notes (where applicable):

1. Pre-construction survey includes costs associated with performing an aerial survey, supplemental field survey, in-field property boundary delineations, field marking OU features to be protected (e.g., monitoring wells), and cross sections within Portage Creek prior to construction.
2. Air monitoring unit cost assumes that monitoring activities are required during COC-containing material handling only (e.g., excavation, consolidation, subgrade preparation).
6. Clearing and grubbing unit cost is based on cutting and chipping of medium to heavily forested area and grubbing of stumps and other miscellaneous debris within the areas subject to consolidation and final cover system.
7. Temporary steel sheeting cost estimate is based on the assumption that approximately 1,200 linear feet of 15-foot long steel sheeting will be installed to facilitate earthwork activities along the bank of Portage Creek adjacent to the Monarch HRDL.
- 11 - Soil removal and consolidation quantity represents the total quantity of in-situ material requiring excavation prior to offsite disposal. Soil removal and consolidation cost includes excavation and loading of COC-containing materials, onsite transport to placement area within the consolidation areas, and placement and compaction in 12-inch lifts within the consolidation areas. Estimated quantities are based on removal and consolidation of
- 12 Cost for removal and segregation of clean soil cover materials is based on the assumption that approximately 90,000 cubic yards of clean soil cover currently exists on top of the Bryant HRDL/FRDLs, and would be removed and segregated for subsequent use as backfill.
- 13 Soil removal and processing/loading into disposal containers quantity represents the total quantity of in situ material requiring excavation prior to off-site transportation and disposal. Soil removal cost includes excavation and loading of COC-containing materials, as well as soil processing/handling. Volumes of material removed from each area are presented in table 2-3 of the text.
- 13b Estimated backfill quantities are based on backfilling excavation areas to maintain onsite ground surface above the water table and to restore offsite areas to the original elevation. Estimated backfill quantities are 202,500 cubic yards from Former Type III Landfill, 108,000 cubic yards from Western Disposal Area, 4,000 cubic yards from the Panelyte Property, 300 cubic yards from Panelyte Marsh, 100 cubic yards from Conrail, 317,500 cubic yards from Bryant HRDLs/FRDLs, 127,500 from Monarch HRDL, 99,500 from Residential and Commercial Properties, and 100 cubic yards from Former Raceway Channel. Quantities will be revised during remedial design.
- 14 Estimated cost to remove the sheetpile wall assumes that the existing sheetpile wall along the Bryant HRDL/FRDLs will be removed during excavation activities.
- 15 Confirmation sample quantity assumes that all soil removal areas will be sampled on a 50 foot by 50 foot grid to confirm removal of COC-containing material.
- 16 Offsite transportation and disposal cost for TSCA material is based on the assumption that approximately 33% of the soil removed from the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL will require offsite transportation and disposal as TSCA material, and all remaining soils will be managed as non-TSCA. Unit rate obtained as verbal quote from Clean Harbors on 2/1/13.
- 17 Offsite transportation and disposal cost for Non-TSCA material is based on the assumption that approximately 66% of the soil removed from the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL will require offsite transportation and disposal as Non-TSCA material, and all of the excavated soils associated with the Commercial (Goodwill Lawn Area, Goodwill Parking Lot, Consumers Power, and Alcott Street Parking Lot) and Residential/MHLLC Properties (including Golden Age), will also require segregation and offsite disposal as Non-TSCA.
- 19 Topsoil quantity is based on covering approximately 65 acres of soil removal area with 6 inches of topsoil.
- 20 Seed and mulch quantity is based on covering the 65 acres of topsoil placed over the soil removal areas.

TABLE 5-11

Cost Estimate for Remedial Alternative 4*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
I. CAPITAL COSTS					
Site Preparation					
1	Pre-construction Field Survey	1	LS	\$10,400	\$10,400
2	Air Monitoring Program	1400	DAY	\$1,600	\$2,240,000
3	Temporary Fencing	1	LS	\$15,900	\$15,900
4	Decontamination Area	1	EA	\$37,100	\$37,100
5	Temporary Construction Access Roads	1	LS	\$84,800	\$84,800
6	Clearing & Grubbing	20	AC	\$13,000	\$260,000
7	Temporary Steel Sheet piling (Drive, Extract and Salvage: Means 31 41 16.10 0100)	282	TON	\$2,200	\$620,400
8	Utility Protection / Relocation	1	LS	\$106,000	\$106,000
9	Temporary Stormwater Management and Erosion and Sedimentation Controls	1	LS	\$265,000	\$265,000
10	Well Abandonment	18	EA	\$640	\$11,520
Site Preparation Subtotal:					\$3,651,120
Excavation and Consolidation					
11	Survey	60	WK	\$5,300	\$318,000
12	Soil Removal & Onsite Transport to Temporary Staging Area(s)	1,600,000	CY	\$7	\$11,200,000
12a	Construction Water Treatment System	400	days	\$10,600	\$4,240,000
13	Removal & Segregation of Clean Soil Cover from Bryant HRDL/FRDLs	90,000	CY	\$5	\$405,000
14	Loading & Onsite Transport of Soils from Temporary Staging Area(s) to Consolidation Area(s) for Placement	1,200,000	CY	\$9	\$10,800,000
15	Soil Removal & Processing/Loading into Disposal Containers	500,000	CY	\$9.00	\$4,500,000
16	Remove Sheet Pile Wall	2,600	LF	\$120	\$312,000
17	Confirmation Sampling	1,130	EA	\$530	\$598,900
Excavation and Consolidation Subtotal:					\$32,373,900
Offsite Transportation & Disposal					
18	Offsite Transportation & Disposal - Non-TSCA	780,000	TN	\$40	\$31,200,000
Offsite Disposal Subtotal:					\$31,200,000
Base Liner System					
19	Grade Verification Surveys	16	WK	\$53,000	\$848,000
20	Soil Grading Layer (Select Fill)	800,000	CY	\$21	\$16,800,000
21	Secondary Geosynthetic Clay Liner (GCL)	280,000	SY	\$6	\$1,680,000
22	Secondary 40-Mil Flexible Membrane Liner (FML)	280,000	SY	\$9	\$2,520,000
23	Primary GCL	280,000	SY	\$6	\$1,680,000
24	Primary FML	280,000	SY	\$9	\$2,520,000
25	Geosynthetic Drainage Composite (GDC) Layer	280,000	SY	\$6	\$1,680,000
26	Soil Protection/Drainage Layer	78,000	CY	\$21	\$1,638,000
27	Pumpable Sump System	1	LS	\$530,000	\$530,000
28	Leak Detection System	1	LS	\$106,000	\$106,000
Base Liner System Subtotal:					\$30,002,000
Final Cover System					
29	Grade Verification Surveys	16	WK	\$5,300	\$84,800
30	Soil Grading Layer (Select Fill)	39,000	CY	\$21	\$819,000
31	Geotextile Separation Layer (8-oz/sy)	280,000	SY	\$3	\$840,000
32	Gas Venting Layer (Sand)	78,000	CY	\$21	\$1,638,000
33	Passive Gas Vents	60	EA	\$1,100	\$66,000
34	30-mil PVC Liner (or equivalent)	280,000	SY	\$8	\$2,240,000
35	Geotextile Cushion Layer (16-oz/sy)	280,000	SY	\$5	\$1,400,000
36	Soil Protection / Drainage Layer (Sand)	156,000	CY	\$21	\$3,276,000
37	Topsoil Layer	39,000	CY	\$32	\$1,248,000
38	Seed & Mulch	48	AC	\$2,200	\$105,600
Final Cover System Subtotal:					\$11,717,400

TABLE 5-11

Cost Estimate for Remedial Alternative 4*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
Permanent Stormwater Management					
39	Vegetated Swales	16,000	LF	\$15	\$240,000
40	Riprap-lined Swales	7,000	LF	\$100	\$700,000
41	Riprap Slope Protection	1	LS	\$400,000	\$400,000
42	Culverts	1,500	LF	\$30	\$45,000
43	Subsurface Drain Piping	7,000	LF	\$45	\$315,000
44	Stormwater Basins	5	EA	\$80,000	\$400,000
Permanent Stormwater Management Subtotal:					\$2,100,000
Restoration					
45	As-built Survey	6	WK	\$5,000	\$30,000
46	Backfill	80,000	CY	\$20	\$1,600,000
47	Topsoil	14,000	CY	\$30	\$420,000
48	Seed & Mulch	17	AC	\$2,100	\$35,700
49	Permanent Gravel Access Roads	1	LS	\$250,000	\$250,000
Restoration Subtotal:					\$2,335,700
Post-closure Monitoring Features Installation					
50	Installation of Permanent Gas Monitoring Probes	6	EA	\$5,300	\$31,800
51	Installation of Perimeter Gas Venting Trenches	14,500	SF	\$32	\$464,000
52	Installation of Post-closure Groundwater Monitoring Well Network	20	EA	\$6,400	\$128,000
Post-closure Monitoring Features Installation Subtotal:					\$623,800
CAPITAL COST SUBTOTAL:					\$114,003,920
Subcontractor Performance and Payment Bonds (2% of Subtotal Capital Cost):					\$2,280,078
Mobilization/Demobilization:					\$3,000,000
Administration, Design, and Construction Oversight (\$1 million a year):					\$10,000,000
Independent Construction Quality Assurance (5% of Liner System Capital Costs):					\$2,085,970
Contingency (20% of Subtotal Capital Cost):					\$22,800,784
TOTAL CAPITAL COST:					\$154,170,752
II. OPERATION AND MAINTENANCE (O&M) COSTS					
				Discount Rate	1.9%
				Discount	
Post-closure Inspections & Maintenance		Annual Cost	Factor	Net Present Value	
53	Years 1-5	\$100,000	YR	4.73	\$472,717
54	Years 6-30	\$50,000	YR	17.98	\$899,016
Post-closure Inspections & Maintenance Subtotal:					\$1,371,733
Post-closure Landfill Gas Monitoring & Reporting					
55	Years 1-5	\$4,000	YR	4.73	\$18,909
56	Years 6-30	\$2,000	YR	17.98	\$35,961
Post-closure Landfill Gas Monitoring & Reporting Subtotal:					\$54,869
Post-closure Groundwater Sampling & Reporting					
57	Years 1-5	\$200,000	YR	4.73	\$945,434
58	Years 6-30	\$100,000	YR	17.98	\$1,798,032
Post-closure Groundwater Sampling & Reporting Subtotal:					\$2,743,466
O&M COST SUBTOTAL:					\$4,170,069
Contingency (20% of Subtotal O&M Cost):					\$834,014
TOTAL O&M COST:					\$5,004,083
III. PERIODIC COSTS					
				Discount Rate	1.9%
				Discount	
5-Year Reviews		Annual Cost	Factor	Net Present Value	
59	Year 5	\$25,000	YR	0.91	\$22,755
60	Year 10	\$25,000	YR	0.83	\$20,711
61	Year 15	\$25,000	YR	0.75	\$18,851
62	Year 20	\$25,000	YR	0.69	\$17,158
63	Year 25	\$25,000	YR	0.62	\$15,617
64	Year 30	\$25,000	YR	0.57	\$14,214

TABLE 5-11

Cost Estimate for Remedial Alternative 4*Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*

Item No.	Description	Estimated Quantity	Unit Cost (Labor and Materials)		Estimated Cost
			Unit		
TOTAL PERIODIC COST:					\$109,304
TOTAL ESTIMATED COST:					\$159,284,139
ROUNDED TO:					\$159,000,000

General Notes:

This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the projected cost.

Unit prices are based on 2015 dollars.

All volumes represent in-place measures.

Where not otherwise noted, unit cost is based on past project experience.

Mobilization/Demobilization includes, but is not necessary limited to, transportation of personnel, equipment, and materials to and from the OU, temporary utilities and services (i.e., electrical, water, telephone, sanitary), construction trailers, etc. (i.e., with winter shutdown).

CY = Cubic Yard; LF = Linear Feet; LS = Lump Sum; SY = Square Yard; AC = Acre; EA = Each; TN = Ton WK = Week; MO = Month.

Item Notes (where applicable):

1. Pre-construction survey includes costs associated with performing an aerial survey, supplemental field survey, in-field property boundary delineations, field marking OU features to be protected (e.g., monitoring wells), and cross sections within Portage Creek prior to construction.
2. Air monitoring unit cost assumes that monitoring activities are required during COC-containing material handling only (e.g., excavation, consolidation, subgrade preparation).
6. Clearing and grubbing unit cost is based on cutting and chipping of medium to heavily forested area and grubbing of stumps and other miscellaneous debris within the areas subject to consolidation and final cover system.
7. Temporary steel sheeting cost estimate is based on the assumption that approximately 1,200 linear feet of 15-foot long steel sheeting will be installed to facilitate earthwork activities along the bank of Portage Creek adjacent to the Monarch HRDL.
12. Soil removal and consolidation quantity represents the total quantity of in-situ material requiring excavation prior to consolidation within the Former Type III Landfill, Western Disposal Area, and Monarch HRDL consolidation areas. Soil removal and consolidation cost includes excavation and loading of COC-containing materials, onsite transport to placement area within the consolidation areas, and placement and compaction in 12-inch lifts within the consolidation areas. Estimated quantities are based on removal and consolidation of approximately 405,000 cubic yards of material from the Former Type III Landfill, 270,000 cubic yards from the Western Disposal Area, 4,000 cubic yards from the Panelyte Property, 300 cubic yards from Panelyte Marsh, 100 cubic yards from the Conrail Property, 635,000 cubic yards from Bryant HRDLs/FRDLs, 170,000 cubic yards from the Monarch HRDL, 100 yards from Former Raceway Channel, and approximately 99,500 cubic yards of material from Residential and Commercial Properties.
16. Estimated quantity and cost is not based on calculation, rather it is an estimate based on site topography and the potential for sheet pile removal based on slope stability considerations. Lineal footage and costs to be determined during design phase.
17. Confirmation sample quantity assumes that all soil removal areas will be sampled on a 50 foot by 50 foot grid to confirm removal of COC-containing material.
18. Offsite transportation and disposal cost for Non-TSCA material is based on the assumption that approximately 66% of the soil removed from the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL will require offsite transportation and disposal as Non-TSCA material, and all of the excavated soils associated with the Commercial (Goodwill Lawn Area, Goodwill Parking Lot, Consumers Power, and Alcott Street Parking Lot) and Residential/MHLLC Properties (including Golden Age), will also require segregation and offsite disposal as Non-TSCA. Volumes of material to be removed are presented in Table 2-3 of the text.
- 19 - Final cover quantities are based on the following estimated areas: Former Type III Landfill - 10 acres, Western Disposal Area - 12 acres, Bryant HRDLs/FRDLs - 20.7 acres, and Monarch HRDL - 5.2 acres.
20. Soil grading layer cost estimate is based on an assumed 10-foot-thick layer of select fill covering the entire areas subject to base liner installation, as required to ensure that the base liner system is a minimum of 10 feet above the groundwater table.
21. Secondary geosynthetic clay liner (GCL) cost estimate assumes utilizing a GCL as a soil-clay substitute covering the entire base liner system areas, and includes an additional 20% material quantity to account for overlap and wrinkles.
22. Estimated cost for secondary 40-mil flexible membrane liner (FML) is based on the assumption that an impermeable liner will be placed as part of the base liner of the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL. This quantity includes an additional 20% material quantity to account for overlap and wrinkles.
23. Primary GCL cost estimate assumes using a GCL as a soil-clay substitute covering the entire base liner system areas, and includes an additional 20% material quantity to account for overlap and wrinkles.
24. Estimated cost for primary 40-mil FML is based on the assumption that an additional impermeable liner will be placed as part of the base liner of the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL. This quantity includes an additional 20% material quantity to account for overlap and wrinkles.
25. Estimated cost for installation of geosynthetic drainage composite (GDC) layer is based on the assumption that a GDC layer will be placed as part of the base liner systems of the Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL. The estimated quantity includes an additional 20% material quantity to account for overlap and wrinkles.
26. Soil protection/drainage layer consists of a 1-foot-thick layer of sand covering the entire base liner system area.

TABLE 5-11

Cost Estimate for Remedial Alternative 4

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Item No.	Description	Estimated Quantity	Unit	Unit Cost (Labor and Materials)	Estimated Cost
30	Soil grading layer cost estimate is based on an assumed 6-inch-thick layer of select fill covering the entire consolidation/cover system areas and is the first layer of the earthen cover system.				
31	Geotextile separation layer cost estimate assumes utilizing a non-woven geotextile covering the entire cover system areas, and includes an additional 20% material quantity to account for overlap and wrinkles. Unit cost is based on information provided by geotextile manufacturer.				
36	Soil protection/drainage layer consists of a 1-foot-thick layer of sand covering the entire cover system area.				
37	Topsoil layer consists of a 6-inch-thick layer of topsoil covering the entire cover system areas.				
38	Seed and mulch cost estimate is based on seeding and mulching the entire area subject to consolidation/final cover system.				
39	Total length of the vegetated swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
40	Total length of the riprap-lined swale is based on a conceptual cover system layout prepared for cost estimating purposes only.				
42	Total length of culvert piping is based on a conceptual cover system layout prepared for cost estimating purposes only.				
43	It is anticipated that subsurface drainage would be installed at the interface between the consolidation area and the existing Bryant HRDLs and FRDLs liner system. Liner system grades at the interface are assumed to slope downward on a 4 on 1 slope forming a v-notch channel containing the subsurface drainage piping.				
44	Stormwater basin unit cost represents an average per basin cost, which was developed from a conceptual stormwater basin configuration.				
45 -	Restoration quantity assumes approximately 17 acres of soil removal area, located outside the limits of capping, as specified in the following: Former				
49	Type III Landfill - 3.6 acres, Western Disposal Area - 3.6 acres, Bryant HRDL/RDL - 1.5 acres, Monarch HRDL - 1.6 acres, commercial properties - 5.3 acres and Residential/MHLLC-Owned properties including Golden Age) - 1.5 acres.				
46	The estimated cost for backfill assumes that the voids created by removal of PCB-containing soil from the Commercial (Goodwill Lawn Area, Goodwill Parking Lots, Consumers Power, and Alcott Street Parking Lot) and Residential/MHLLC Properties (including Golden Age) will be replaced with clean backfill to within 6 inches of pre-existing grades (allowing for subsequent topsoil placement).				
47	Topsoil quantity is based on covering approximately 17 acres of disturbed area, located outside the limits of capping, with 6 inches of topsoil.				
48	Seed and mulch quantity is based on covering the 17 acres of topsoil placed over the outlying soil removal areas, Monarch landfill area, and consolidation area as necessary to promote vegetative growth.				
49	Permanent access road quantity based on an assumed 8,000 linear feet of newly constructed road that will be required to access various portions of the cover system area for maintenance purposes.				
53 -					
58	Net present value (NPV) factors calculated using the following equation:				

$$NPV = I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + \dots + \frac{I_n}{(1+r)^n}$$

r = Discount rate (expressed as decimal)

n = Number of years from present

Appendix B
Applicable or Relevant and
Appropriate Regulations

SUMMARY OF FEDERAL AND STATE ARARS, AND LOCAL CONSIDERATIONS
 OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Requirement	Citation	Description	ARAR/TBC	Rationale
Federal				
Action-Specific				
Toxic Substances Control Act (TSCA)	15 USC § 2601 to 2692	This regulation establishes prohibitions of, and requirements for, the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB Items.	Applicable	Provides clean up levels and disposal requirements for PCB remediation waste including that from Superfund sites. Also allows for a site-specific risk-based evaluation for cleanup and disposal.
	40 CFR § 761.61 40 CFR 761.50(b)(3)	Under 40 C.F.R. §761.50(b)(3), PCB remediation waste is “regulated for cleanup and disposal in accordance with 40 C.F.R. §761.61.” 40 C.F.R. §761.3 defines PCB remediation waste as “waste containing PCBs as a result of a spill, release, or other unauthorized disposal ... at any concentration from a source not authorized for use under TSCA. PCB remediation waste includes “environmental media containing PCBs, such as soil and gravel, dredged materials, such as sediments, settled sediment fines, and aqueous decantate from sediment.” 40 C.F.R. §761.61(a)(4) defines “bulk PCB remediation waste “to include “soil, sediments, dredged materials, muds, PCB sewage sludge, and industrial sludges.” 40 C.F.R. §761.61(c) allows for a risk based method for cleanup or disposal of PCB remediation waste when USEPA finds that that the method of disposal will not pose an unreasonable risk of injury to human health and the environment. 40 CFR §761.61(a)8 describes deed restrictions. 40 CFR §761.61(a)(5)(i)(B)(2) sets forth requirements for off-site disposal of remediation waste.	Applicable	A risk based method for PCB remediation waste, including on-site disposal, can be approved by USEPA if the remedial alternative does not pose an unreasonable risk of injury to health or the environment. Soil/sediment from OU1 that contain PCB concentrations and are intended for offsite disposal will comply with 40 CFR §761.61(a)(5)(i)(B)(2) and 40 CFR §761.62(a)(5)(v). Alternatives with offsite disposal of soil/sediment with PCB concentrations < 50 ppm will likely be disposed of in a licensed state solid waste facility.
Clean Water Act (CWA) (See Federal Water Pollution	33 USC § §1344 40 CFR § 230 33 CFR § 323 40 CFR 230.94(c)	Requires approval from USACE for discharge of dredged or fill material into waters of the United States (CWA Section 404 Permit) including the creek, floodplain, or wetland. Provides guidelines to	Applicable	See also Section 10 of the Rivers and Harbors Appropriations Act. The substantive requirements of a permit for discharge of dredged materials will

SUMMARY OF FEDERAL AND STATE ARARS, AND LOCAL CONSIDERATIONS
OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Requirement	Citation	Description	ARAR/TBC	Rationale
Control Act) and corresponding regulations		restore and maintain the chemical, physical, and biological integrity of waters of the U.S. by controlling discharge of fill material. If any wetlands are filled, Superfund policy is to require a minimum of one acre of wetlands mitigation for each acre of wetland filled. (See “Considering Wetlands at CERCLA Sites” OSWER 9280.0-03). The Federal Mitigation Rule is set forth at 40 C.F.R. § 230.94(c)(2-14).		be met. Excavation within the creek would constitute discharge of dredged material. Requirements are likely to include measures to minimize re-suspension of sediments and erosion of sediments during excavation. Wetlands were delineated as part of the RI. Applicable for remedial alternatives that impact wetlands.
	33 USC § §1251 40 CFR § 122 40 CFR § 125 40 CFR § 136	Types of discharges regulated under the CWA include: discharge to surface water (including storm water), direct discharge to a POTW, and discharge of dredged or fill material into United States waters. Establishes site-specific pollutant limitations and performance standards which are designed to protect surface water quality. Requires implementation of best management practices to control run-off from construction activities.	Applicable	Applies to remediation alternatives which treat and/or discharge water. State standards that are more restrictive than federal criteria become the applicable requirement, consistent with CERCLA 121(d). Best management practices will likely include minimal clearing for grading and equipment operations, erosion and sediment control measures, and structural controls required to control surface water runoff.
	40 CFR § 129	Establishes effluent standards for toxic compounds including PCBs.	Applicable	Applicable for remedial alternatives that would include discharge of water to Portage Creek.
Section 10 of the Rivers & Harbors Appropriation Act of 1899	33 USC § 403	Requires approval from USACE for dredging and filling work performed in a navigable waterway of the U.S. Prohibits creation of any obstructions not affirmatively authorized by Congress to the navigable capacity of any water in the United States.	Applicable	Remedial activities may be conducted in such a way as to avoid obstruction or alteration to Portage Creek channel including removal of material abutting the Portage Creek channel. Nationwide Permit #38 is applicable. Typical substantive requirements of dredging permits include measures to minimize re-suspension of sediments, and minimize effects on natural and historic resources See also Clean Water Act

SUMMARY OF FEDERAL AND STATE ARARS, AND LOCAL CONSIDERATIONS
OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Requirement	Citation	Description	ARAR/TBC	Rationale
Criteria For Classification Of Solid Waste Disposal Facilities And Practices	40 CFR § 257	Sets forth criteria for determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment.		These criteria apply to the consolidation of wastes on OU1.
Criteria for Classification of Solid Waste Disposal Facilities and Practices (RCRA Regulations)	40 CFR § 257	Establishes standards for the management and disposal of solid waste, including: 1) Facility or practices in floodplains will not restrict the flow of base flood, reduce the temporary water storage capacity of the floodplain, or otherwise result in a washout of solid waste; 2) Facility or practices shall not cause discharge of dredged or fill material into waters of the United States; 3) Facility or practice shall not allow uncontrolled public access so as to expose the public to potential health and safety hazards; 4) Covers groundwater monitoring and corrective action requirements under Subpart E and closure and post closure care under Subpart F.	TBC	May be considered as it offers guidance on management and disposal of waste.
Resource Conservation and Recovery Act (RCRA) (see Solid Waste Disposal Act)	42 USC §§ 6901 to 6992k	RCRA addresses solid and hazardous wastes in or on the land; requires the conversion of existing open dumps to facilities which do not pose a danger to the environment or to health.	Applicable	Provides standards for management of solid waste.
Clean Air Act	42 USC §§ 7401 to 7671q	Establishes requirements for sources of hazardous air pollutants such as PCBs; establishes requirements for constituent emission rates in accordance with National Ambient Air Quality Standards.	Applicable	Applies to CERCLA sites that may emit measurable quantities of hazardous air pollutants and particulate matter if threshold values are exceeded. Here there may be a release of a particulate matter and hazardous air pollutants during clearing, grubbing, excavation or cap installation.
		Provides guidelines with respect to minimizing the harmful effects of fugitive dust and airborne contaminants that result from excavation,	Applicable	May be appropriate for remedial alternatives that include excavation/removal of residual/ soil.

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		construction, and other removal activities. Establishes primary and secondary ambient air quality standards for emissions of chemicals and particulate matter.		
Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites	OSWER Directive 9200.4-26	This Directive sets forth policy basis for these recommended levels and prescribes procedures for implementing these recommendations.	TBC	Dioxins are present in surficial soils where sampled. Additional sampling will be conducted to confirm that dioxins do not exceed recommended levels.
Migratory Bird Treaty Act	16 USC 703–711	Establishes federal responsibility for the protection of the international migratory bird resources. Taking, killing, or possessing migratory birds is unlawful. If migratory birds, their active nests, or eggs are discovered they may not be disturbed or destroyed.	Applicable	The presence of migratory birds will be evaluated and during remedial design and appropriate measures implemented during remedial construction to assure that the cleanup of the Site does not unnecessarily impact migratory birds.
Location-Specific				
Executive Order 11990 – Protection of Wetlands	42 Fed. Reg. 26961 (May 24,1977)	Orders federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when carrying out federally required activities.	TBC	Any dredging, excavation or filling operation, field work disturbing designated wetlands or floodplains are required to adhere to the conditions of the executive orders.
Executive Order 11988 – Floodplain Management	42 Fed. Reg 26951 (May 24, 1977)	Addresses floodplain management and the evaluation by federal agencies of the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	TBC	Any access roads will be designed to minimize the direct impact of the floodplain and any reuse scenarios considered will be evaluated in accordance with this executive order.
Fish and Wildlife Coordination Act	16 USC §§ 661-667e	Protects fish and wildlife wherever federal actions result in the control or modification of a stream or other body of water; Consultation with the Bureau of Fisheries is performed with the intent of protecting and preserving wildlife.	Applicable	OU1 is not known to be a habitat for endangered species or wildlife. US Fish and Wildlife Service and Michigan Department of Natural Resources consultations will be performed prior to construction.
Joint regulations on interagency cooperation	16 USC §§ §1531-1544 50 CFR § Part 402	Requires federal agencies to ensure that the continued existence of any endangered or	Applicable	OU1 is not known to be a habitat for endangered species or wildlife. State

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regarding the Endangered Species Act		threatened species and their habitats will not be jeopardized by a site action.		and federal consultations will be performed prior to construction.
Chemical-Specific				
Clean Water Act	33 USC §§ 1251-1387	EPA has developed water quality criteria for 1) protection of human health; and 2) protection of aquatic life.	Applicable	Response activities conducted at the site must meet the appropriate established protective criteria.
State				
Action-Specific				
Michigan Natural resources and Environmental Protection Act (NREPA), Public Act 451, Part 31 - Water Resources Protection	MCL 324.3101-3133	Prohibits direct or indirect discharge of a substance that is injurious to public health, recreational use, or aquatic life. Establishes rules specifying standards for several water quality parameters	Applicable	Any remedial action that results in the unacceptable discharge of injurious substances will not be considered effective or complete.
Michigan Public Act 451, Part 115 – Solid Waste Management	MCL 324 11502-22550	Establishes rules for methods of solid waste disposal and for design/operational standards for disposal areas. Describes where Type III landfill standards apply. Rules provide specifications for Type III landfill final cover design to minimize erosion and infiltration to protect public health; Type III landfill groundwater monitoring requirements, requirements for hydrogeologic monitoring plan, monitoring network, and associated sampling, requirements for final cover materials, and Construction Quality Controls.	Relevant and Appropriate	Type III standards cover design requirements and substantive portions of Construction Quality Control are relevant and appropriate to the Allied OU. A design that keeps the final cover from being inundated is capable of limiting erosion and infiltration to the extent necessary to protect human health and the environment.
Michigan Public Act 451, Part 201 – Environmental Remediation	MCL 324.20101 - 20142	Requires that a remedial action shall provide for response activity that will satisfy cleanup criteria; requirements for owner of facility, such as preventing exacerbation and exercising due care; restrictions on transfer of real property designated as a facility, and requirements that if residential criteria are not met, land use restrictions,	Applicable	The remedial action implemented must meet generic or site-specific cleanup criteria; due to existing contamination, property cannot be transferred without land use restrictions, including restrictive covenants, that apply to the site. All actions leaving contamination in place

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		<p>including restrictive covenants must be provided. Actions required upon approval of remedial action plans, elements of remedial action plans; required action if contaminated soil is moved off-site or relocated within the site. Also MCL 324.20120e requires that a response action demonstrate compliance with groundwater/surface water requirements for groundwater venting to surface water.</p>		<p>must, with county register of deeds, record restrictions on activities that may interfere with the integrity of the remedial action and on activities that may result in unacceptable exposure. Substantive requirements can be met in remedial design documents; for example, by including an aquifer monitoring plan and operation and maintenance plan. Such plans identify points of compliance for judging the effectiveness of the remedial action. Material moved off site must be evaluated to determine if it is subject to Part 111.</p>
<p>Michigan Public Act 451, Part 301 - Inland Lakes and Streams</p>	<p>MAC R 299.5520-5540, MAC R 299.51001-51021</p>	<p>Objectives of response activities, determination (or nullification) that a response activity is complete; Required elements of remedial action plans; Requirements for land use restrictions if residential criteria are not met; notice to the department and adjacent land owners in certain situations, such as if hazardous substances emanate beyond the property boundary.</p>	<p>Applicable</p>	<p>When the response action is complete, the entity initiating the action has the burden of demonstrating that the action meets all requirements; Substantive requirements can be met in remedial design documents. For example, by including an aquifer monitoring plan and operation and maintenance plan. Such plans identify points of compliance for judging the effectiveness of the remedial action. All actions leaving contamination in place must, with county register of deeds, record restrictions on activities that may interfere with the integrity of the remedial action and on activities that may result in unacceptable exposure.</p>
	<p>MAC R 281.951-965</p>	<p>Regulates dredging or filling of lake or stream bottoms</p>	<p>Applicable</p>	<p>For remedial alternatives involving any fill in the river channel or streambeds, activities may be restricted by these regulations.</p>

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Requirement	Citation	Description	ARAR/TBC	Rationale
Michigan Public Act 451, Part 91 - Soil Erosion and Sediment Control	MCL 324.9101-324.9123a	Requirements for owners of land undergoing an earth change. Establishes rules prescribing soil erosion and sedimentation control plans, procedures, and measures.	Applicable	For any remedial action involving an earth change, implement and maintain soil erosion and sedimentation control measures. Substantive requirements of permit must be satisfied.
	MAC R 323.1701-1714	Requirements for owners of land undergoing an earth change. Establishes rules prescribing soil erosion and sedimentation control plans, procedures, and measures.	Applicable	For any remedial action involving an earth change, implement and maintain soil erosion and sedimentation control measures. Substantive requirements of permit must be satisfied.
Michigan Public Act 451, Part 31 - Water Resources Protection	MCL 324.3101-3133	Prohibition of discharge of waste or waste effluent into surface water without approval of the State and establishment of rules; provisions in 3109b allow for mixing zone for discharge of venting groundwater, 310 prohibits filling or grading of a floodplain unless permitted by the State, and 3109b defines when Part 31 remedial obligations are met.	Applicable	Substantive requirements of a NPDES permit must be attained. For any remedial alternative where waste is left in place, the mixing zone criteria shall not be less protective than for point source discharges. For any remedial alternative meeting the requirements of Part 201, Part 31 requirements are satisfied.
	MAC R 323.1041 - 323.1117; R 323.1171 - 323.1181; R 323.1201 - 323.1221; R 323.1311 - 323.1329; R 323.1701 - 323.1714; R 323.2101-323.2197; R 323.2201 - 323.2240; R 323.2301 - 323.2317; R 323.3001 - 323.3027; R 324.2001 - 324.2009	Prohibition of discharge waste or waste effluent into surface water without approval of the State and establishment of rules	Applicable	Certain remedial alternatives may involve discharge of waters to the Kalamazoo River. Substantive requirements of a NPDES permit must be attained.
Michigan Public Act 451, Part 111- Hazardous Waste Management	MCL 324.11105	Establishes requirements for hazardous waste generators, transporters, and treatment/storage/disposal facilities.	Applicable	Allied Operable Unit is not a TSD facility or a generator. Response activities may generate waste material that may be classified as hazardous waste from former mill operations. Used for characterizing and identifying hazardous wastes and determining appropriate disposal options.
	MAC R 299.9101 -11107	Establishes requirements for hazardous waste generators, transporters, and treatment/storage/disposal facilities.	Applicable	Allied Operable Unit is not a TSD facility or a generator. Response activities may generate waste material that may be classified as hazardous waste from

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Requirement	Citation	Description	ARAR/TBC	Rationale
				former mill operations. Used for characterizing and identifying hazardous wastes and determining appropriate disposal options.
Michigan Public Act 451, Part 55 - Air Pollution Control	MCL 324.5501-324.5542	Establishes rules prohibiting the emission of air contaminants in quantities which cause injurious effects to human health, animal life, plant life or significant economic value, and/or property.	Applicable	Applicable for remedial alternatives that would generate air emissions (e.g., dust, during excavation, soil stabilization, or compaction) if threshold values are exceeded. For certain remedial alternatives, air emissions must comply with substantive requirements of permits and monitoring would be required.
	MAC R 336.1101-2706	Establishes rules prohibiting the emission of air contaminants in quantities which cause injurious effects to human health, animal life, plant life or significant economic value, and/or property.	Applicable	Applicable for remedial alternatives that would generate air emissions (e.g., dust, during excavation, soil stabilization, or compaction) if threshold values are exceeded. For certain remedial alternatives, air emissions must comply with substantive requirements of permits and monitoring would be required.
Location-Specific				
Michigan Public Act 451, Part 303 -wetland Protection	MCL 324.30301 - 324.30329	Provides for protection and conservation of wetlands, including establishing rules regarding wetland uses and prohibitions on future use.	Applicable	For certain remedial alternatives, these regulations may limit potential work and/or storage areas and future reuse.
	MAC R 281.921-925, R 281.951-281.961	Provides categories and types of wetlands and corresponding mitigation ratios for impacts to varying types of wetlands, as well as availability of wetland banking	Applicable	Ratios and mitigation requirements may inform decisions about work in wetland areas.
Chemical-Specific				
Michigan Public Act 451, Part 201 – Environmental Remediation	MAC R 299.5701-299.5752	Part 7 Rules: Cleanup Criteria Requirements for Remedial Actions and Interim Response	Applicable	The remedial action implemented must meet generic or site-specific cleanup criteria, applicable to all environmental media and may be used to gauge the success of the remedial action.

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Michigan Natural resources and Environmental Protection Act (NREPA), Public Act 451, Part 31 - Water Resources Protection	Michigan Administrative Code (MAC) R 323.1041-1116 (Part 4 Rules)	The Part 4 Rules specify water quality standards which shall be met in all waters of the state. The rules require that all designated uses of the receiving water be protected, including indigenous aquatic life and wildlife.	Relevant and Appropriate	These rules drive the need to reduce contaminant loading to Portage Creek and the Kalamazoo River. Surface water quality standards may be used to assess surface water quality in the vicinity of the Allied Paper Operable Unit and as a means to gauge effectiveness of a remedial action.
	MAC R 323.1201-1221 (Part 8, Water Quality-Based Effluent Limit Development for Toxic Substance Rules)	In accordance with federal WPCA and CWA, the Part 8 Rules establish chemical specific water quality-based effluent limits (WQBELs) for point-source discharges.	Applicable	Part 31 and its promulgated rules are to be complied with during environmental remediation conducted pursuant to Part 201. Criteria are applicable to venting groundwater, storm water, and discharge associated with implementing the remedial action.
	MAC R 323.2101-2104, 2136-2140, 2142-2145, 2149, 2152-2155, 2160-2161, 2190 (Part 21, Wastewater Discharge Rules)	The Part 21 Rules establish a waste effluent discharge system compatible with NPDES.	Applicable	Substantive requirements of state discharge permits (including storm water permits) must be attained for remedial actions taking place on site.
	MAC R 323.1311-1329 (Part 13, Floodways and Floodways Rules)	Regulates activities to occupy, fill, or grade lands in a floodplain, streambed, or channel of a stream.	Applicable	The OU lies within the 100-year floodplain. Substantive requirements would need to be met for certain remedial activities
Michigan Public Act 451, Part 201 – Environmental Remediation	MCL 324.20101 - MCL 324.20142	Part 201 establishes rules specifying site cleanup criteria, including risk-based cleanup criteria. Requires that remedial action be consistent with cleanup criteria. Generic and site-specific criteria deemed to meet the protectiveness requirement.	Applicable	By statute, the Allied OU is a "facility." Response activities conducted at the site must meet the appropriate state-established protective criteria. If these criteria are attained, the remedial action will be considered protective by MDEQ.
	MAC R 299.5101-5117, R299.5701-5752 Statutorily-required (see MCL 324.20120a(1)(b) criteria found at: http://www.michigan.gov/deq/0,1607,7-135-3311_4109_9846_30022-251790--,00.html)	Rules provide residential cleanup criteria for soil and groundwater	Applicable	By statute, the Allied OU is a "facility." Response activities conducted at the site must meet the appropriate state-established protective criteria. If these criteria are attained, the remedial action will be considered protective by MDEQ.

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	NREPA Part 201 Criteria Tables	Tables for nonresidential and residential soil and groundwater criteria.	Applicable	By statute, the Allied OU is a "facility." Response activities conducted at the site must meet the appropriate state-established protective criteria. If these criteria are attained, the remedial action will be considered protective by MDEQ.
Local Considerations (which are not ARARs)				
Noise	Chapter 21—Code of the City of Kalamazoo	Secures/promotes the public health, comfort, convenience, safety, and welfare of City residents; promotes peace & quiet.		Certain remedial alternatives may involve machinery that may exceed noise limits for private property without special considerations.
Soil Erosion and Sedimentation Control	Chapter 30 – Code of the City of Kalamazoo	Control soil erosion and sedimentation with respect to earth change activities within the City.		For any remedial action involving an earth change, implement and maintain soil erosion and sedimentation control measures. Substantive requirements of permit must be satisfied.
City of Kalamazoo Performance Standards for Groundwater Protection within Wellhead Protection Capture Zones and Stormwater Quality Management.	--	Defines technical standards for site development that facilities located within the Capture Zones are required to attain for drinking water source protection and to protect surface water quality by establishing acceptable stormwater quality management strategies throughout the City. Includes best management practices.		OU1 is within one of the City’s 5-year time-of-travel capture zones for a well field.
Drinking Water Well Installation	Chapter 19b, Chapter 24b, Chapter 25b, Kalamazoo County Sanitary Code --Chapter 30 – Code of the City of Kalamazoo	Prohibits certain uses of groundwater from wells at properties located in the vicinity of such sites that are the source, or location, of Contaminated Groundwater, or where there is a known threat from Contaminated Groundwater.		OU1 is within a restricted zone, prohibiting any drinking well installation within the area.
Groundwater Sites of Concern,	--	Location of Restricted zones referred to in Kalamazoo County Sanitary Code, Chapter 19b.		OU1 is within a restricted zone, prohibiting any drinking well installation within the area.

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Kalamazoo Township, City of Kalamazoo, City of Parchment, Kalamazoo County, Michigan				

List of Acronyms:

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| ARAR = Applicable or Relevant and Appropriate Requirements | TSCA = Toxic Substances Control Act |
| CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act | USC = United States Federal Code |
| CFR = Code of Federal Regulations | USEPA = U.S. Environmental Protection Agency |
| CWA = Clean Water Act | USACE = U.S. Army Corps of Engineers |
| GSI = groundwater surface water interface | USDOT = U.S. Department of Transportation |
| MAC = Michigan Administrative Code | |
| MCL = Michigan Compiled Laws | |
| MDEQ = Michigan Department of Environmental Quality | |
| mg/kg = milligrams per kilogram | |
| NPDES = National Pollutant Discharge Elimination System | |
| OU = operable unit | |
| PCBs = polychlorinated biphenyls | |
| POTW = Publicly Owned Treatment Works | |
| RCRA = Resource Conservation and Recovery Act | |
| TBC = to be considered | |