Site: West Lake Landfill
ID # MSD079901932
Break: 4.0 / 012
Other: 0714
6-12-06

Feasibility Study Report

West Lake Landfill
Operable Unit 2
Bridgeton, Missouri

Revision 1

June 2006

RECEIVED
JUN 1 2 2006
SUPERFUND DIVISION

HERST & ASSOCIATES, INC.®

4630 South Highway 94
North Outer Road
St. Charles, Missouri 63304
Telephone: (636) 939-9111
Facsimile: (636) 939-9757

40249275
SUPERFUND RECORDS

WLLFOIA4312 - 001 - 0052956

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Purpose and Scope of the Feasibility Study Report 1
1.2 Background Information 1
1.2.1 Site Description 1
1.2.2 Site History / Summary of Landfill Operations at the Site 3
1.2.2.1 Radiological Area 1 4
1.2.2.2 Radiological Area 2 4
1.2.2.3 Closed Demolition Landfill 5
1.2.2.4 Former Active Sanitary Landfill Operations 5
1.2.2.5 Inactive Landfill 5
1.2.2.6 Activities Adjacent To The Site 6
1.2.3 Nature and Extent of Contamination 6
1.3 Baseline Risk Assessment 7

2.0 APPLICABLE AND RELEVANT OR APPROPRIATE REGULATIONS 10
2.1 Potential Applicable or Relevant and Appropriate Requirements (ARARs) 10
2.1.1 Permitted Portions of OU-2 12
2.1.1.1 Former Active Sanitary Landfill 12
2.1.1.2 Closed Demolition Landfill 13
2.1.1.3 Inactive Landfill 13
2.1.2 Potential Chemical-Specific ARARs 14
2.1.2.1 MCLs and MCLGs 14
2.1.2.2 Missouri Drinking Water Standards 15
2.1.2.3 CWA 15
2.1.2.4 Missouri Water Quality Standards 16
2.1.3 Potential Location-Specific ARARs 17
2.1.4 Potential Action-Specific ARARs 17
2.1.4.1 RCRA Subtitle D 17
2.1.4.2 Missouri Solid Waste Rules for Sanitary Landfills 18
2.1.4.3 Construction-Related Regulatory Requirements – Missouri Air Quality Regulations, Missouri Storm Water Discharge and Management Regulations, and Missouri Groundwater Extraction or Monitoring Well Construction Code, ... 24
2.1.4.4 Missouri Landfill Post-Closure Care and Corrective Action Plans 26

3.0 RESPONSE ACTION OBJECTIVES 27

4.0 GENERAL RESPONSE ACTIONS 35

5.0 DEVELOPMENT OF ALTERNATIVES 40
5.1 Alternative 1 – No Action 40
5.2 Alternative 2 – MDNR-Prescribed Cover with Long-Term Monitoring and Institutional Controls 41

6.0 DETAILED ANALYSIS OF ALTERNATIVES 44
6.1 Alternative 1 - No Action Alternative 46
6.1.1 Overall Protection of Human Health and the Environment 46
6.1.2 Compliance with ARARs 47
6.1.3 Long-Term Effectiveness and Permanence 47
6.1.4 Reduction of Toxicity, Mobility, and Volume Through Treatment 47

6.1.5 Short-Term Effectiveness 47
6.1.6 Implementability 47
6.1.7 Costs 47
6.2 Alternative 2 – MDNR-Prescribed Cover with Long-Term Monitoring and Institutional Controls 48
6.2.1 Overall Protection of Human Health and the Environment 48
6.2.2 Compliance with ARARs 48
6.2.3 Long-Term Effectiveness and Permanence 48
6.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment 48
6.2.5 Short-Term Effectiveness 49
6.2.6 Implementability 49
6.2.7 Costs 49
7.0 COMPARATIVE ANALYSIS OF ALTERNATIVES 50
7.1 Overall Protection of Human Health and the Environment 50
7.2 Compliance with ARARs 50
7.3 Long-Term Effectiveness and Permanence 50
7.4 Reduction in Toxicity, Mobility, or Volume through Treatment 51
7.5 Short-Term Effectiveness 51
7.6 Implementability 52
7.7 Cost 53
7.8 State (Support Agency) Acceptance 54
7.9 Community Acceptance 54
7.10 Consistency with Operable Unit 1 54
8.0 REFERENCES 55

LIST OF TABLES

Table 2-1: Preliminary Identification of Potential Chemical-Specific ARARs and TBC Criteria
Table 2-2: Preliminary Identification of Potential Location-Specific ARARs and TBC Criteria
Table 2-3: Preliminary Identification of Potential Action-Specific ARARs and TBC Criteria

LIST OF FIGURES

1-1 Site Map Location
1-2 Zoning & Land Use Map
1-3 Leachate Risers – Former Active Sanitary Landfill
1-4 Missouri Department of Natural Resources Permitted Areas
1-5 Potential Liquid Disposal Area Inferred by the EPA
1-6 Site-Wide Landfill Area Boundaries
1-7 Stormwater Monitoring Locations
4-1 Technical Implementability Screening of Remediation Technologies & Process Options
4-2 Evaluation of Remediation Technologies & Process Options

5-1 State of Missouri – Prescribed Cover Cross-Section View
5-2 Alternative 2 – State of Missouri Prescribed Cover
5-3 Site-Wide Groundwater Monitoring Well Locations
5-4 Proposed Perimeter Gas Probe Location Map – Approximately 500 ft spacing
7-1 Alternative 2 – State of Missouri Projected Topography
7-2 Projected Final Cover Contours for the Inactive Landfill and Operable Unit 1 Area 2

LIST OF APPENDICES

Appendix A Closure/Post-Closure Plan for Former Active Sanitary Landfill
Appendix B Post-Closure Plan for Closed Demolition Landfill
Appendix C Cost Estimate Details

1.0 INTRODUCTION

This Feasibility Study (FS) report has been prepared by Herst & Associates, Inc. on behalf of Allied Waste Industries (Bridgeton), Inc. The FS report has been prepared as part of the Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit 2 (OU-2) at the West Lake Landfill site (the Site) located in Bridgeton, Missouri.

The FS report has been prepared in accordance with the requirements of Administrative Order on Consent (AOC) Docket number VII-94-F-0025 (EPA Region VII, 1994 and 1996), between the U.S. Environmental Protection Agency (EPA) and the Respondent for OU-2 at the West Lake Landfill. Specifically, this report presents the information required by Section 6.2 of the Remedial Investigation/Feasibility Study (RI/FS) Statement of Work (SOW) to the AOC.

1.1 Purpose and Scope of the Feasibility Study Report

The purpose of the FS report is to provide a basis for remedy selection by EPA and to document the development and analysis of remedial alternatives. As suggested by Section 6.2 of the SOW, the FS report should include the following, as listed in the Interim Final Guidance for Conducting Remedial Investigations and Feasibility Study Reports Under CERCLA (OSWER Directive 9355.3-01 (EPA, 1988)):

- Identification and Screening of Technologies
- Development of Alternatives
- Detailed Analysis of Alternatives

It is important to note that the Administrative Order on Consent (Docket No. VII-94-F-0025) and the EPA-approved Final Remedial Investigation/Feasibility Study Work Plan (Work Plan (Golder, 1995)) indicate that the Presumptive Remedy for CERCLA Municipal Landfills Sites (OSWER Directive No. 9355.0-49FS (EPA, 1993a)) is also a governing document. The following FS report incorporates requirements from OSWER Directive 9355.3-01 as modified by OSWER Directive No. 9355.0-49FS (EPA, 1993a).

1.2 Background Information

This section presents a brief description of the site background, including a site description, site history, nature and extent of contamination, and baseline risk assessment.

1.2.1 Site Description

The West Lake (Bridgeton) Landfill site is a 212-acre facility located within the City of Bridgeton, St. Louis County, Missouri (Figure 1-1). The site address is 13570 St. Charles Rock Road. The site includes a formerly active solid waste landfill, a closed demolition landfill, an inactive solid waste landfill, concrete and asphalt plants, and an automobile repair shop (Figure 1-2). The site was used agriculturally until 1939, when a limestone quarry and crushing operation was initiated.

As shown in Figure 1-2, the West Lake Site is bounded on the north by St. Charles Rock Road and on the east by Taussig Road and agricultural land. Old St. Charles Rock Road borders the southern and western portions of the site. Property north of the site (across St.

Charles Rock Road) is moderately developed with commercial retail and industrial operations. The property northeast of the site is also developed for commercial uses. The property south of the site is currently experiencing significant commercial development. The Earth City industrial park is adjacent to the site on the west. The West Lake Site is now almost completely surrounded by commercial/industrial properties.

The southern portion of the Site is zoned M-1 (manufacturing district, limited). A zoning and land use map are shown in Figure 1-2. The southernmost portion of the Site is permitted for Former Active Sanitary landfill operations (Permit No. 118912). Although the northern portion of the Site is zoned R-1 (one family dwelling district), a deed restriction has been recorded against the entire Site prohibiting residential use and groundwater use. The deed restriction cannot be terminated without the written approval of the current owners, MDNR, and EPA.

The site is located in the eastern edge of the Missouri River floodplain. The Missouri River is located approximately two miles west of the site. The site remained above the high water elevation during the St. Louis-area floods of 1993 (an approximate 500 year flood event) and 1995. The area is transitional between the alluvial floodplain immediately to the west and the loessial bluffs 0.5 miles to the east. The edge of the alluvial valley is oriented north to south through the center of the site (Figure 1-2). Topography in the area is gently rolling. However, site topography has been significantly altered by quarry activities in the eastern portion, and placement of mine spoils (unused quarry rock) and landfilled materials in the western portion.

The limestone quarry was operated between 1939 and 1988, and was closed when economically recoverable reserves were exhausted. The quarry consisted of two pits, which were excavated to a maximum depth of about 240 feet below ground surface (bottom elevation of about 240 feet above mean sea level, MSL). A sanitary landfill was operated within the limestone quarry pits. Landfilling operations were initiated within the north pit of the quarry in 1979 and later moved into the south pit. Landfilling in the north pit terminated at a maximum elevation of about 500 feet MSL. Activities at the south pit terminated with solid waste at an elevation of about 580 feet MSL. The Former Active Sanitary Landfill ceased accepting wastes in 2005 and closure activities are scheduled to be completed in 2006. In this FS report, the designation "Former Active Sanitary Landfill" will be used.

The Former Active Sanitary Landfill was constructed with a gas collection system and separate leachate collection system. The gas collection system is designed to alleviate potential odor problems and recover gas for potential beneficial use. The leachate collection system is of hydrogeologic importance because it is designed to remove surface water and groundwater which flow into the Former Active Sanitary landfill. The leachate collection system, therefore, acts as a groundwater sink to the groundwater surrounding the Former Active Sanitary Landfill. The leachate collection system currently includes seven leachate collection sumps (Figure 1-3). Six of the sumps (LCS-1B, LCS-2C, LCS-3C, LCS-4A, LCS-5A and LCS-6A) are located within the former quarry pits, and extend to approximately the base of the landfill. In accordance with terms of the landfill permit, the sump pumps are typically activated to maintain a maximum of 30 feet of leachate head in the landfill. The seventh leachate collection sump, labeled LCS-128K, is located adjacent to the Former Active Sanitary Landfill. Sump LCS-128K is approximately 30 feet deep, and is pumped to remove groundwater within the alluvial materials adjacent to the landfill. The leachate collection system collects an average of about 32.5 million gallons of leachate per year from the Former Active Sanitary Landfill area. The collected leachate is pumped to the St. Louis Metropolitan Sewer District (MSD). Through 2004, leachate was pumped to a temporary

leachate holding pond, where it was aerated prior to discharge to MSD. In 2004, the leachate holding pond underwent clean closure by draining the pond and removing accumulated sediments. A report was submitted to EPA and Missouri Department of Natural Resources (MDNR) in April 2005 documenting the leachate pond closure (Feezor Engineering, 2005). The Engineering Section of the MDNR subsequently approved the leachate pond closure in a letter dated September 12, 2005.

1.2.2 Site History / Summary of Landfill Operations at the Site

The following historical operations summary was derived from McLaren-Hart (1994) and has been supplemented with other pertinent information.

Mine spoils from the quarrying operations were deposited on adjacent land immediately to the west of the quarry, within the OU-2 study area. Limestone, concrete, and asphalt processing was conducted on-site during quarry operations; asphalt and concrete activities continue to date. The processing operations were conducted primarily in the central portion of the facility. Beginning in the early 1950s, portions of the quarried areas and adjacent areas were used for landfilling municipal refuse, industrial solid wastes and construction demolition debris. Initial landfilling activities were not subject to State permitting. In 1974, a State landfill permit was obtained and landfilling began in the portion of the site described as the North Quarry Pit. Landfilling continued in this area until 1985 when the landfill underwent expansion to the southeast in the area described as the South Quarry Pit. Landfill activities conducted after 1974 within the quarry area were subject to a permit from the MDNR.

Based on available data, solid waste disposal may have begun at the site as early as 1952 (Midwest Environmental Consultants, 1995), although many sources cite 1962 as the initial date for waste disposal. Waste disposal in Missouri was regulated solely by St. Louis County authorities until 1974, when the MDNR was formed. At the West Lake site, the MDNR closed certain waste disposal sites on the northern portion of the site and issued State permits for disposal of sanitary and demolition wastes in other areas. Waste disposal continued during and after cessation of mining activities, using the quarry pits as landfill cells. The MDNR permit areas are highlighted on Figure 1-4.

The West Lake site has been divided into two operable units. Operable Unit 1 (OU-1) consists of two areas of radiologically impacted materials present at the West Lake Landfill and a third area of impacted soils at the adjacent off-site property formerly owned by Ford Motor Credit Company and referred to in previous documents as the Ford property. The radiologically impacted materials in OU-1 originated when 8,700 tons of leached barium sulfate residues containing approximately 7 tons of uranium were mixed with approximately 39,000 tons of soil during a cleanup of Cotter Corporation's facilities at 9200 Latty Avenue from July to October, 1973. Cotter Corporation had stored the 8,700 tons of leached barium residues, which it obtained through Continental Mining Corporation from the Department of Energy, at the Latty Avenue facility. B&K Construction transported the materials to the site, where it represented the materials as "clean" fill to site personnel. The materials apparently were used as daily and intermediate cover in routine landfill operations (NUREG-1308, "Radioactive Material in the West Lake Landfill, Summary Report," June 1988). The West Lake Landfill site was placed on the National Priorities List (NPL) in 1990, based primarily on the presence of radiological isomers and the associated potential for groundwater contamination. Operable Unit 1 is being characterized under *Administrative Order on*

Consent, Docket No. VII-93-F-005 (EPA, 1993b and 1997). A baseline risk assessment has previously been prepared for OU-1 (Auxier, 1998).

Operable Unit 2 (OU-2) refers to areas where landfill activities have been or are being conducted at the West Lake Landfill, with the exception of Operable Unit 1 Area 1 and Operable Unit 1 Area 2. OU-2 was created because of EPA's inference that the former limestone quarry area had been used for landfilling municipal refuse, industrial solid wastes, and construction demolition debris. EPA also inferred, based on historic aerial photographs, that standing water pools in what is now referred to as the Inactive Landfill area represented potential liquid disposal areas (Figure 1-5).

The West Lake Landfill can be divided into the following five distinct areas (Figure 1-2):

- Radiological Area 1 within and adjacent to the Former Active Sanitary Landfill boundary (OU-1)
- Radiological Area 2 adjacent to the Closed Demolition Landfill (OU-1)
- Closed demolition landfill (OU-2)
- Former Active Sanitary Landfill (OU-2)
- Inactive Landfill (OU-2)

These five areas are illustrated on Figure 1-6 and are briefly discussed below.

1.2.2.1 Radiological Area 1

Radiological Area 1 is located immediately to the southeast of the Site entrance. This area was part of the unregulated landfill operations conducted prior to 1974. Based on the drilling logs obtained as part of the RI/FS investigations for OU-1, the waste materials within Area 1 consist of municipal refuse (sanitary wastes) with an average thickness of approximately 36 feet.

Based on the results of the Overland Gamma Survey conducted as part of the RI/FS (McLaren-Hart, 1996), Area 1 consists of approximately 10 acres that have been impacted by radiological materials. There is an asphalt entrance road and parking area located on the northwestern border of Area 1 near the Site office building. The remaining portions of Area 1 are mainly covered with grass.

1.2.2.2 Radiological Area 2

Radiological Area 2 is located in the northwestern part of the Site. This area was also part of the unregulated landfill operations conducted prior to 1974. Based on the drilling logs obtained as part of the RI/FS investigations for OU-1, the waste materials within Area 2 consist of construction and demolition debris and municipal refuse with an average thickness of approximately 30 feet.

Based on the results of the Overland Gamma Survey conducted as part of the RI/FS (McLaren-Hart, 1996), Area 2 consists of approximately 30 acres that have been impacted by radiological materials. Large portions of this area are covered with grasses, native bushes and trees while other portions are unvegetated and covered with soil, gravel, concrete rubble

and miscellaneous debris consisting of concrete pipe, metal and automobile parts, discarded building materials, and other non-perishable materials. Scattered throughout Area 2 are a number of small depressions, some of which seasonally contain ponded water and phreatophytes such as cattails. The northern and western portions of Area 2 are bounded by the landfill berm.

1.2.2.3 Closed Demolition Landfill

In addition to Radiological Areas 1 and 2, a closed demolition landfill is located in the northern portion of the Site. The Closed Demolition Landfill is located on the southeast side of Radiological Area 2, between Area 2 and the landfill entrance road. There is no evidence that the Closed Demolition Landfill (which ceased accepting waste in June 1995), received or disposed of wastes outside the scope of its permit. The Closed Demolition Landfill accepted demolition wastes pursuant to Missouri Operating Permit numbers 218912 and 21903, and is subject to an October 1987 Closure Plan and Missouri state closure and post-closure regulations. As such, the remedial requirements for the Closed Demolition Landfill portion of the OU-2 site are established by those permit terms, laws, and regulations. It is therefore appropriate for the Closed Demolition Landfill to remain under the State of Missouri regulatory program, and remedial action evaluations as part of this CERCLA Feasibility Study are not considered warranted.

1.2.2.4 Former Active Sanitary Landfill Operations

Permitted landfilling activities began in 1974 in the Former Active Sanitary Landfill area and were conducted subject Missouri state sanitary landfill and wastewater permits – most recently, MDNR Operating Permit numbers 118912 (solid waste) and MO-0112771 (wastewater). Extensive information is available regarding the operations conducted and the nature and configuration of the waste materials disposed of in this portion of OU-2 (McLaren-Hart, 1994). The Former Active Sanitary Landfill ceased receiving municipal solid waste in February 2005 pursuant to an agreement with the City of St. Louis to reduce the potential harm to airport operations from birds that may be attracted to a sanitary landfill. This agreement was recorded as a negative easement on the entire West Lake Landfill site in April 2005. A transfer station now exists within this area of Operable Unit 2.

The Former Active Sanitary Landfill is undergoing closure and post-closure pursuant to its State of Missouri permits and State of Missouri solid waste regulations. As such, the remedial requirements for the Former Active Sanitary Landfill portion of the OU-2 site are established by those permit terms, plans, and regulations, and remedial action evaluations as part of this CERCLA Feasibility Study are not considered warranted.

1.2.2.5 Inactive Landfill

The Inactive Landfill is located in the western portion of the Site, southwest of the closed demolition landfill. Wastes disposed of in this area are believed to consist of sanitary wastes. There is no evidence that the Inactive Landfill received or disposed of wastes outside the scope of its permit. The Inactive Landfill ceased accepting wastes in 1975, but was not officially "closed" under Missouri state landfill statutes or regulations. Data collected during the Remedial Investigation indicates that a remedial action evaluation is warranted for the Inactive Landfill. Accordingly, the Inactive Landfill is appropriate for further consideration under this CERCLA Feasibility Study.

1.2.2.6 Activities Adjacent To The Site

The property on the west side of Area 2 (the Ford property or the Crossroads property) is currently being developed as an industrial park. The subdivision plat for the Ford property, known as Crossroads Industrial Park, currently reflects a 1.785-acre buffer created adjacent to the Area 2 slope. This Buffer Zone includes the area of radiological impacted surface soils as identified in the "Phase III Radiological Site Assessment" performed by Dames and Moore (Dames and Moore, 1991) for Ford Financial Services Group (Ford) in 1991. Remedial investigation activities conducted as part of the OU-1 RI/FS included additional sampling of the Ford Property. These additional results are discussed in the OU-1 RI Report (Engineering Management Support, Inc., 2000).

1.2.3 Nature and Extent of Contamination

The OU-2 Remedial Investigation (RI) was conducted to characterize the affected media, location, types, and physical state, and concentration of contaminants, and to describe the extent of contamination migration on the OU-2 portions of the site. The OU-2 objectives were met by defining site physical and biological characteristics, site hydrogeologic characteristics, sources of contamination, surface and sediment quality, and air quality. Site physical characteristics were presented in detail in the *Physical Characterization Memorandum* (Golder, 1996) previously submitted to EPA. Site biological characteristics were sufficiently established under the OU-1 RI activities. Site hydrogeologic characteristics described in the *Physical Characterization Memorandum* were supplemented with detailed groundwater quality assessment. Source characterization activities included installation of leachate risers to characterize leachate quality in the Former Active Sanitary Landfill and in the Inactive Landfill, as well as landfill gas analyses. Surface water and sediment sampling provided reliable data regarding potential groundwater impacted on adjacent surface waters and sediments. Air quality was evaluated by Health and Safety air monitoring conducted during investigative activities and by air quality monitoring conducted in perimeter landfill gas probes.

Based on the extensive data collected as part of the OU-2 RI, no hazardous substance source areas were identified. The Former Active Sanitary landfill maintains an inward hydraulic gradient, drawing surrounding groundwater into leachate collection sumps. The Inactive Landfill leachate quality is similar to the Former Active Sanitary landfill leachate quality and does not include solvent compounds that might be associated with the disposal of hazardous substances. The Inactive Landfill has exhibited sporadic detections of landfill gas.

Sampling conducted as part of the OU-2 RI identified a small area of shallow groundwater impact near the extreme southwest corner of the Inactive Landfill. The impacted groundwater near the Inactive Landfill exhibited detectable concentrations of petroleum hydrocarbons and VOCs. TheOU-2 Baseline Risk Assessment (Veritox, 2005) confirmed that the identified concentrations represent a potential current and/or future health risk. As detailed in the *Remedial Investigation Report* (Herst & Associates, Inc., 2005), the potential source of the impacts could be either the Inactive Landfill or a leaking underground storage tank (LUST) site east of the Inactive Landfill, between the Inactive Landfill and the Former Active Sanitary Landfill.

Surface water and sediment results indicate that the localized area of impacted groundwater is not measurably affecting downgradient surface waters and sediments.

1.3 Baseline Risk Assessment

The OU-2 Baseline Risk Assessment (BRA) was prepared in accordance with the presumptive remedy approach for municipal landfills. The EPA has recognized that certain categories of site – for example, municipal landfill – have similar characteristics, such as types of contaminants, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, EPA has initiated the use of presumptive remedies to accelerate cleanups at these types of sites.

Field investigative activities for OU-2 were designed to meet the objectives of Section 3.1 of the Statement of Work (SOW). As described in the EPA-approved Remedial Investigation/Feasibility Study Work Plan, West Lake Landfill OU-2, Bridgeton, Missouri (Work Plan), Appendix A-01, Field Sampling Plan prepared by Golder Associates, Inc. (Golder, 1995), the primary objectives of the West Lake Landfill Operable Unit 2 (OU-2) RI were to collect data on and adjacent to OU-2 regarding environmental characteristics, chemical occurrence, potential chemical migration pathways, and transport mechanisms. These data were used in the evaluation and qualitative assessment of risk associated with exposures to contaminants present at the OU-2 site.

The streamlined approach to evaluating risks at CERCLA municipal landfill sites differs from the typical baseline risk assessment in that quantitative calculations of intakes and risks are not conducted. Instead, pathways that present an obvious threat to human health and the environment are identified by comparing site-specific contaminant concentrations to established standards or risk-based chemical concentrations (EPA, 1991b). Both standards and risk-based chemical concentrations were used in the streamlined Baseline Risk Assessment for OU-2. Standards used included maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) as presented in 40 CFR 141. Risk-based chemical concentrations were developed using standard default exposure assumptions, EPA toxicity data and target cancer risks or target hazard quotients. The risk-based concentrations used in the streamlined BRA for OU-2 were the EPA Region 9 Preliminary Remediation Goals (PRGs).

Groundwater had both potential chemical-specific standards (i.e., MCLs or non-zero MCLGs) and PRGs. Only PRGs were available to evaluate the other media. Maximum concentrations of detected contaminants in a medium were compared to the MCL, non-zero MCLG, or PRG. This methodology serves as a conservative evaluation to identify potential impacts to human health because the maximum concentration was not present at all locations. For the OU-2 BRA, (and consistent with the streamlined approach recommended by EPA (EPA, 1991b)), if the site specific contamination concentration of a confirmed parameters exceeded a standard (i.e., MCL or non-zero MCLG), that compound was considered a Contaminant of Concern for risk assessment. If no standard existed, then the site-specific contaminant concentration was compared to a PRG based on maximum beneficial use, which was presumed to be residential. Residential use is an unrealistic worst-case scenario for the West Lake site, based on the rationale provided in the Baseline Risk Assessment. Contaminants that exceeded a PRG but did not exceed an existing standard were not considered Contaminants of Concern.

Soil results from West Lake Landfill Site Characterization activities did not exceed recommended PRGs. Therefore, there were no contaminants of concern identified for this medium.

Leachate sampling of the West Lake Landfill as part of the Site Characterization process identified a minimal number of contaminants. There are no standards for leachate constituents and comparison to PRGs based on drinking water is not appropriate because leachate is not used as a drinking water source. Parameters detected in leachate were useful for identification of contaminants that could impact groundwater potentially used as a drinking water source. Two identified leachate compounds also appear as COCs in groundwater: arsenic and benzene. In general, the leachate from the Inactive Landfill had fewer detected parameters and at lower concentrations than leachate from the Former Active Sanitary Landfill. This is probably due to the greater age of the Inactive Landfill, which ceased accepting waste materials in 1975. The leachate sampling results also do not support the prior EPA inference that liquid hazardous waste disposal occurred in the Inactive Landfill.

Landfill gas monitoring conducted as part of the West Lake Landfill Site Characterization process identified sporadic, isolated landfill gas impacts which are typical for a solid waste landfill. It is unlikely that any individual would be exposed to the parameters identified in the landfill gas under the types of conditions on which the PRGs are based. Furthermore, exposures will likely occur for short periods of time during routine maintenance and/or landfill gas monitoring activities. Given these factors, the parameters detected in the landfill gases are unlikely to pose an exposure concern at the detected levels.

In the streamlined approach being used for this BRA, only a qualitative estimate of risk was needed. In essence, if a detected parameter exceeded a given standard (MCL or non-zero MCLG) in the environmental media tested, an unacceptable risk was deemed to exist and remedial action might be warranted. This approach does not consider the fact that there are no drinking water uses or users of groundwater near the West Lake site at this time.

Carcinogenic contaminants exceeding MCLs or non-zero MCLGs which were identified in the alluvial groundwater sampling for the West Lake Landfill are: arsenic, benzene, and vinyl chloride.

Non-carcinogenic contaminants that exceeded MCLs or non-zero MCLGs in the West Lake Landfill groundwater are: iron, manganese, chloride, total dissolved solids, and fluoride. However, most of these conventional parameters appear to reflect background groundwater conditions. Total petroleum hydrocarbons also exceeded the MDNR Tier 1 Cleanup Levels (MDNR, 2001), apparently as a result of releases from a Leaking Underground Storage Tank discussed in more detail in the Remedial Investigation Report.

A qualitative ecological evaluation was conducted for OU-2. Although local populations of some common species may be present in the area, OU-2 is not a highly sensitive or ecologically unique environment. The streamlined risk assessment for OU-2, as discussed in the human health evaluation, identified groundwater as the primary media of concern. Groundwater is not readily accessible to ecological receptors and the site characterization suggests that groundwater will not adversely impact ecologically sensitive areas. Surface water and sediment sampling results do not indicate off-site release of contaminants from run-off and on-site sampling does not suggest that there would be releases through run off in the future.

There is no current or anticipated future drinking water use of the groundwater near the landfill. Using the presumptive remedy approach for municipal landfills, both carcinogenic and non-carcinogenic contaminants were identified in groundwater at concentrations that exceeded their MCLs or non-zero MCLGs.

Based on the findings discussed above, consideration of remedial action for the Inactive Landfill under the presumptive remedy approach is warranted for the Inactive Landfill.

2.0 APPLICABLE AND RELEVANT OR APPROPRIATE REGULATIONS

2.1 Potential Applicable or Relevant and Appropriate Requirements (ARARs)

Remedial actions under the Comprehensive Environmental Response, Compensation and Liability Act, (42 U.S.C. § 9601 et seq., CERCLA or Superfund), must be analyzed for compliance with applicable, or relevant and appropriate, requirements (ARARs) of environmental laws other than CERCLA. Compliance with ARARs is one of the criteria used in a Feasibility Study (FS) to evaluate potential remedial alternatives. The identification and evaluation of potential ARARs provides a basis for the development and detailed analysis of remedial alternatives. This subsection identifies potential ARARs for the Inactive Landfill portion of the West Lake Landfill OU-2.

An environmental protection requirement established under environmental laws other than CERCLA may be either "applicable" or "relevant and appropriate" to a Superfund cleanup. When determining potential ARARs for a remedial action, a two-tier test applies. First, determine whether the regulation is applicable. Second, if the regulation is not applicable, then determine whether the regulation is nevertheless relevant and appropriate.

"Applicable" environmental protection requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Applicable requirements are compulsory – a specific state or federal law or regulation mandates that any remedial action adhere to the applicable requirement.

In turn, "relevant and appropriate" requirements are those cleanup standards, standards of control, or other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that do not directly and fully address site conditions, but which involve similar situations or problems to those encountered at a CERCLA site. Whether a requirement is relevant and appropriate, both of which must be satisfied to qualify as an ARAR, depends on factors such as the duration of the response action, the form or concentration of the chemicals present, the nature of the release, or the availability of other standards that more directly match the circumstances at the site.

More specifically, when proceeding through the "relevant and appropriate" phase of an ARARs analysis, two determinations must be answered affirmatively.

> First, to determine relevance a comparison is made between the action, location, or chemicals covered by the requirement and related conditions of the site, release, or potential remedy; a requirement is relevant if the requirement generally pertains to these conditions;

and

> second, to determine whether the requirement is appropriate, the comparison is further refined by focusing on the nature of the substances, the characterization of the site, the circumstances of the release, and the proposed remedial action; the requirement is

appropriate if, based on such comparison, its use is well-suited to the particular site.

Proposed National Oil and Hazardous Substances Contingency Plan (NCP), 53 Fed. Reg. 51394, 51436-37 (Dec. 21, 1988).

The decision to incorporate an inapplicable requirement into a remedial action is justified only when the requirement is both relevant and appropriate. The NCP further provides that in evaluating ARARs, a decisionmaker should consider the following to determine relevance and appropriateness:

- The purpose of the requirement and the purpose of the CERCLA action;
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;
- The substances regulated by the requirement and the substances found at the CERCLA site;
- The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site;
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;
- The type of place regulated and the type of place affected by the release or CERCLA action;
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action; and
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site.

40 CFR Section 300.400(g) (2).

Only the substantive portions of a law or regulation are to be considered potential ARARs. Administrative or procedural requirements such as permitting or record-keeping requirements are not considered ARARs.

Standards, limits, guidance or advisories that do not qualify as promulgated laws and regulations may nonetheless be taken into account when determining the cleanup level to be achieved at a site. Such non-promulgated guidance or advisories are "To Be Considered" (TBC) criteria. TBC criteria are not legally binding requirements, and therefore do not have the same status as potential ARARs. TBCs, however, may be evaluated and considered where no ARARs exist. Examples of TBCs include peer reviewed health effect information, guidance documents or policy documents, and local zoning requirements. Although TBCs are not ARARs, compliance with TBCs may be required to protect human health or the environment.

Determining applicability, relevance and appropriateness, and TBC compliance occurs on a site-specific, case-by-case basis.

Once an environmental requirement is found to be an ARAR, any cleanup action must comply with its terms unless EPA grants an ARAR waiver in the ROD, using the statutory requirements of CERCLA Section 121(d) (4). Waiver requirements are:

- Interim remedy – Compliance with an ARAR can be waived if the remedial action is only a part of a total remedial action that will attain the ARAR when completed.
- Greater risk – Compliance with an ARAR can be waived if compliance with the ARAR would result in greater risk to human health and the environment than the non-ARAR compliant alternative selected.
- Technical impracticability – Compliance with an ARAR can be waived if it is technically impracticable from an engineering perspective.
- Equivalent standard – Compliance with an ARAR can be waived if the remedy selected will attain an equivalent standard of performance through use of another approach.
- Inconsistent application of State requirements – Compliance with an ARAR can be waived if the State has not consistently applied the requirement (or demonstrated an intention to apply it consistently) in similar circumstances at other remedial actions.
- Fund balancing – This waiver is for Superfund financed actions only. Compliance with an ARAR can be waived in order to provide a balance between the need for protection at the site, and the availability of fund monies to respond to other sites.

ARARs themselves fall into three categories:

- Chemical-specific ARARs;
- Location-specific ARARs; and
- Action-specific ARARs.

2.1.1 Permitted Portions of OU-2

As a preliminary matter, USEPA has divided the West Lake Landfill into two separate investigation and study units. The first, OU-1, consists of two non-contiguous areas of radiological interest. These OU-1 areas are the subject of their own RI and FS, and will not be covered in this document. The remainder of the landfilled areas at the site makes up the area of investigation and study known as the West Lake Landfill OU-2. In its turn, OU-2 can be divided into three parts: the Former Active Sanitary Landfill, the Closed Demolition Landfill, and the Inactive Landfill.

2.1.1.1 Former Active Sanitary Landfill

Most of the eastern portion of the site is taken up by an area referred to as the Former Active Sanitary Landfill, which operated under MDNR sanitary landfill disposal permit No. 118912, St. Louis County Air Pollution Control Program operating permit No. OP2001009 (application for renewal submitted Aug. 9, 2004), St. Louis County Health Department sanitary landfill operating license No. 418 and demolition landfill operating license No. 419, and general storm water discharge permit No. MO-R103310. The Former Active Sanitary Landfill also included a leachate retention pond separated from the site by Old St. Charles Rock Road.

The leachate retention pond was closed in September 2005 pursuant to a work plan approved by the MDNR, and the landfill itself ceased accepting wastes in 2005.

The Former Active Sanitary Landfill continues to discharge wastewater under Missouri Clean Water Law and federal National Pollutant Discharge Elimination System (NPDES) permit No. MO-0112771, and Metropolitan St. Louis Sewer District (MSD) Industrial Wastewater Discharge permit No. 05115598-02. In addition, a Closure and Post-Closure Plan is in place which meets the applicable requirements of 40 C.F.R. Part 258, Subpart F; the Missouri Solid Waste Law, Sections 260.226 and 260.227; Missouri Regulations found at 10 C.S.R. Part 80-3; and the St. Louis County Management Code, Chapter 607.

The terms of Permits No. 118912 (closure and post-closure), MO-0112771 and 05115598-02 (wastewater), OP2001009 (air), and R103310 (storm water) qualify as applicable environmental requirements promulgated under state and federal law. The terms of these permits dictate the closure and post-closure activities to be performed at the Former Active Sanitary Landfill portion of the West Lake Landfill OU-2.

Additionally, the RCRA Subtitle D regulations (40 CFR Part 258, Subpart B) contain requirements for new or existing municipal solid waste landfills or lateral expansions that are located within 10,000 feet of any airport runway end used by turbojet aircraft or 5,000 feet of any airport runway end used by only piston-type aircraft. Such landfills or expansions must demonstrate that the units are designed and operated so that a MSWLF unit does not pose a bird hazard to aircraft. MDNR regulations for solid waste management include a similar provision for sanitary landfills (10 CSR 80-3.010 (4)(B)(1)). Portions of the Former Active Sanitary Landfill are located within 10,000 feet of the end of the runway under construction as part of the expansion of the Lambert-St. Louis International Airport. The Former Active Sanitary Landfill was designed and is managed under the Closure and Post-Closure Plan so that it does not pose a bird hazard to aircraft.

The remainder of this document will presume compliance with the permit terms, the RCRA Subtitle D bird hazard requirements, and 10 C.S.R. part 80-3 for the Former Active Sanitary Landfill.

2.1.1.2 Closed Demolition Landfill

The Closed Demolition Landfill operated under MDNR permit Nos. 218912 and 218903, ceased accepting materials in 1975, and is subject to an October, 1987 Closure Plan (permit No. 84-075-1-001). The Closure Plan for the Closed Demolition Landfill qualifies as an applicable environmental requirement promulgated under state and federal law. The terms of that plan dictate the closure and post-closure activities to be performed at the Closed Demolition Landfill portion of the West Lake Landfill OU-2. The remainder of this document will presume compliance with the permit terms and 10 C.S.R. part 80-4 for the Closed Demolition Landfill.

2.1.1.3 Inactive Landfill

The only remaining unaddressed portion of the West Lake Landfill OU-2 is the Inactive Landfill, which is the subject of the following ARARs analysis.

2.1.2 Potential Chemical-Specific ARARs

Chemical-specific ARARs include those laws and requirements that regulate the release of materials possessing certain chemical or physical characteristics, or containing specified chemical compounds. These requirements are generally health- or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. If a chemical is subject to more than one discharge or exposure limit, the more stringent requirement generally should be applied.

Based on the streamlined approach to evaluating risks at CERCLA municipal landfill sites and the results of the Baseline Risk Assessment described in Section 1.3 above, potential chemical-specific ARARs for the Inactive Landfill are:

- Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) and non-zero maximum contaminants level goals (MCLGs) for public drinking water systems;
- Missouri Drinking Water Standards;
- Clean Water Act (CWA) discharge limits; and
- Missouri Water Quality Standards.

A summary of these potential chemical-specific ARARs appears at Table 2-1.

2.1.2.1 MCLs and MCLGs

For any remedial action that results in hazardous substances, pollutants or contaminants remaining on-site, CERCLA Section 121(2) (A) requires considering the Safe Drinking Water Act (SDWA) as a potential ARAR. The SDWA uses national primary drinking water regulations (primary standards), to protect drinking water quality by limiting the levels of specific contaminants ("parameters") that can adversely affect public health and which are known or anticipated to occur in public water systems. These primary standards are codified as numerical limits known as maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs), and reflect the level of human health protection that may be achieved for a particular parameter or contaminant after taking into consideration the use of best available technology, treatment techniques, and cost. In turn, MCLG's are non-enforceable health goals. 40 C.F.R. § 141.2. States may promulgate secondary drinking water standards, consisting of secondary maximum contaminant levels (SMCLs) to provide reasonable targets for addressing contaminant parameters that affect taste, odor, or the aesthetic quality of drinking water, or which could impact drinking water infrasystem with problems such as corrosivity.

In the West Lake Landfill OU-2 RI Report, iron, manganese and total dissolved solids (TDSs) were found to exceed MCLs or MCLGs in groundwater. Additional hydrogeologic unit contaminants in some, but not all, portions of the subsurface aquifers were found at levels above MCLs or MCLGs and included arsenic, chloride, total petroleum hydrocarbons (TPH), benzene, vinyl chloride and fluoride. The majority of the inorganic and conventional parameters that exceeded MCLs or non-zero MCLGs in the aquifers may be explained by variations in background levels of groundwater constituents.

The SDWA limits human consumption of water containing contaminants above their respective MCLs from public drinking water systems serving 25 or more individuals. 40 C.F.R. § 141.2. Missouri regulations also establish MCLs for public drinking water systems. 10 CSR 60-4.010, et seq. The West Lake Landfill does not operate a public drinking water system, therefore these regulations are not applicable to the remedial actions under consideration for OU-2. Further, the West Lake landfill property is subject to restrictive covenants running with the land that prohibit groundwater wells, residential use, and construction of buildings on-site. The possibility exists, however, for groundwater with contaminants to move off-site in the future, where it could be available to off-site residential or commercial receptors. Because MCLs apply only to public water supply systems serving 25 or more individuals the MCLs are not applicable requirements, but they may be potentially relevant and appropriate requirements.

2.1.2.2 Missouri Drinking Water Standards

Missouri also has promulgated regulations setting maximum contaminant levels (Missouri MCLs) for community or public water systems. 10 C.S.R. 60-4.010 *et seq.* These regulations apply to water systems serving at least 25 individuals or at least fifteen service connections. 10 C.S.R. 60-2.015 (2)(C)(9) & (2)(P)(5).

The Missouri public drinking water program limits human consumption of water containing contaminants above their respective Missouri MCLs. 10 CSR 60-4.010 *et seq.* The West Lake Landfill does not operate a public drinking water system, therefore these regulations are not applicable to the remedial actions under consideration for OU-2. Further, the West Lake landfill property is subject to restrictive covenants running with the land that prohibit groundwater wells, residential use, and construction of buildings on-site. The possibility exists, however, for groundwater with contaminants to move off-site in the future, where it could be available to off-site residential or commercial receptors. Because Missouri MCLs apply only to public water supply systems serving 25 or more individuals Missouri MCLs are not applicable requirements, but they may be potentially relevant and appropriate requirements.

2.1.2.3 CWA

The primary purpose of the Clean Water Act (CWA) (also known as the Federal Water Pollution Control Act, 33 U.S.C. § 1311 et seq.), is to restore and maintain the quality of the nation's surface waters by restricting discharges of designated pollutants. Under CERCLA, all CWA priority toxic pollutants are considered CERCLA hazardous substances. CERCLA remedial actions also must adhere to applicable or relevant and appropriate CWA standards, including those covering direct discharges to surface waters, indirect discharges to publicly owned treatment works (POTWs), and discharges of dredge-and-fill materials into navigable waters.

The CWA controls direct discharges of pollutants through the NPDES program (33 C.F.R. part 402). The NPDES standards govern technology-based pollutant controls, such as effluent control technologies. It also covers ambient water quality standards including federal water quality criteria (FWQC) and state water quality standards (WQS), which set concentrations for pollutants considered adequate to protect surface waters, as well as state anti-degradation standards designed to protect existing water uses and maintain water quality.

The CWA also controls indirect discharges of wastewaters to POTWs via performance-based and technology-based pretreatment standards. Discharges from a CERCLA site to a POTW are considered to be an off-site activity and subject to both substantive and administrative requirements of federal, state and local regulatory programs.

Additionally, the CWA manages storm water runoff from land disturbance projects (construction activities) which disturb an acre or more of land. Finally, Section 404 of the CWA regulates the discharge of dredged or fill material into navigable waters, including wetlands.

The CWA requirements apply to any CERCLA remedy for the West Lake landfill.

The Former Active Sanitary Landfill has an NPDES direct discharge permit, an MSD POTW indirect discharge permit, and a general permit for storm water runoff. The Former Active Sanitary Landfill complies with the requirements set out in these permits. For example, the Former Active Sanitary Landfill's extensive leachate collection and discharge system pumps approximately 32.5 million gallons of leachate and collected run-off precipitation per year to the POTW pursuant to the MSD permit. This system also collects surface water from most of the rest of OU-2, including the Inactive Landfill. The Closure and Post-Closure requirements of the Former Active Sanitary Landfill require continued implementation of these permits.

To the extent the Inactive Landfill generates or produces leachate, surface water or storm water discharges or releases to underground waterbodies, these discharges are subject to the CWA and the CWA is an applicable requirement.

At the West Lake Landfill, surface water discharges are captured by the permitted control technologies and systems implemented for the Former Active Sanitary Landfill. Further, the OU-2 RI Report concluded that, based on surface water and sediment sampling results, the Inactive Landfill is not contributing measurable surface water contamination to the nearest surface water body, the Earth City storm water retention pond. Finally, there does not appear to be any likelihood of dredge-and-fill excavations at West Lake Landfill which would be subject to Section 404 permit requirements.

The land disturbance/storm water runoff provisions of the CWA will be addressed below as part of the action-specific ARARs analysis for construction activities at the Inactive Landfill. The stormwater discharges are subject to the substantive requirements of the CWA.

2.1.2.4 Missouri Water Quality Standards

Missouri water quality regulations found at 10 C.S.R. 20-7.031 et seq. establish anti-degradation policies with three levels of protection for Missouri surface water bodies. The regulations also set general water quality criteria applicable to all waters of the state, and specific criteria for classified waters of the state. The general and specific criteria apply to both surface water bodies (lakes and streams) and subsurface waters (groundwater aquifers). The Missouri Water Quality Standards are applicable to any discharges from the Inactive Landfill.

The Inactive Landfill's water discharges route through the NPDES, MSD POTW and general storm water permits and control technologies in place for the Former Active Sanitary Landfill. The NPDES permits include Missouri Water Quality Standards limitations – for example,

turbidity and color restrictions. Any Inactive Landfill groundwater discharges must comply with the specific criteria set out for at 10 C.S.R. 20-7.031 (5).

2.1.3 Potential Location-Specific ARARs

Location-specific ARARs are those requirements that relate to the geographical or physical location of the site or remedial action rather than the nature of the contaminants or the proposed cleanup. Location-specific ARARs prevent damage to unique or sensitive areas, such as floodplains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they occur. These requirements may limit the type of implementable remedial action, or may impose additional constraints. Evaluations of potential location-specific ARARs are presented on Table 2-2.

2.1.4 Potential Action-Specific ARARs

Action-specific ARARs are activity or technology-based and control remedial activity that involves the design or use of certain equipment, or which regulates discrete cleanup activities. Action-specific ARARs generally set performance or design standards for specific activities related to the handling, treatment, disposal, or other management of wastes. They apply not because of the presence of specific chemicals at a site, but rather because of the remedial technique, technology, or approach selected to accomplish a remedy.

Based on the presumptive remedy approach for municipal landfills, potential action-specific ARARs for the Inactive Landfill are the:

- RCRA Subtitle D, Solid Waste Management Rules;
- Missouri Solid Waste Rules for Sanitary Landfills;
- Construction-Related Regulatory Requirements – Missouri Air Quality Regulations, Missouri Groundwater Extraction or Monitoring Well Construction Code, and Missouri Storm water Discharge and Management Regulations; and
- Missouri Landfill Post-Closure Care and Corrective Action Plans.

A summary of these potential action-specific ARARs appears at Table 2-3.

2.1.4.1 RCRA Subtitle D

The CERCLA presumptive remedy for municipal landfills assumes a Subtitle D landfill cap will be installed and maintained over landfill sites. Under Subtitle D of RCRA, EPA promulgated minimum criteria that apply to currently operating solid waste landfills, including landfill closure and capping requirements. EPA's Subtitle D regulations apply only to new facilities or expansions or facilities that continue to receive waste after 1991; they do not apply to solid waste landfills closed prior to October, 1991. 56 Fed. Reg. 50978-51007 (Oct. 9, 1991). The Inactive Landfill ceased receiving waste on or before 1975. The Subtitle D solid waste requirements, therefore, are not applicable to the Inactive Landfill.

With regard to relevance and appropriateness, under RCRA Subtitle D a state may promulgate equivalent or more stringent regulations for in-state landfills, provided that EPA approves the state's regulatory system. Missouri is such an approved state. Missouri

amended its regulations in 1997 and they became effective July 1, 1997. 22 Mo. Reg. 1008, (June 2, 1997). The Missouri landfill requirements apply to landfills that close after October 9, 1991.

When identifying potential ARARs in a program with approved state status, the ARAR analysis focuses on the State statute or regulation that potentially addresses the specific site's problems and remedies. The authorized State requirement, not the Federal analogue, is examined as the potential ARAR because the state provisions are regarded as the requirements in effect, and thus potentially relevant and appropriate. Thus, under the presumptive remedy approach to the Inactive Landfill, the Missouri Solid Waste Rules for Sanitary Landfills will not be applicable, but may be relevant and appropriate.

2.1.4.2 Missouri Solid Waste Rules for Sanitary Landfills

Missouri is a Federally-approved regulator for solid waste landfill requirements and has promulgated laws and regulatory standards for sanitary landfills. Mo. Rev. Stat. § 260.200 (2002); 10 CSR 80-3.010. Missouri began regulating solid waste disposal landfills in 1974; EPA approved the Missouri regulatory program in 1986. The Inactive Landfill was closed prior to 1986. Missouri's solid waste landfill operation and closure requirements, therefore, are not applicable to the Inactive Landfill.

Although the Subtitle D and Missouri landfill requirements are not applicable to remedial decisions regarding the Inactive Landfill, they may nonetheless be relevant and appropriate and must be analyzed as potential ARARs. Again, the standard for using inapplicable state standards as ARARs at a CERCLA site is both relevance and appropriateness.

Relevance depends on a comparison between the action, location, or chemicals covered by the requirement and the conditions existing at the site. A requirement is relevant if it generally pertains to these on-site conditions.

Appropriateness is similar, and further focuses the comparison on the nature of the substances present, the characteristics of the site, the circumstances of the release, and the purposes of the cleanup. A requirement is appropriate if its use is well-suited to the site.

The Missouri landfill statutes contain general specifications for solid waste disposal facilities. These statutes set out requirements regarding permitting, operation, monitoring, closure and post-closure plans, and financial assurance extending thirty years from the date operations cease. The statutes further specify that upon a confirmed release of contaminants from a permitted landfill during the post-closure period, corrective action must address any groundwater contamination, surface water contamination, or gas migration. Mo. Rev. Stats. §§ 260.226 & 260.227.

MDNR promulgated landfill regulations to further expand on the legislature's statutory provisions. These regulations establish twenty categories of standards for the design and operation of sanitary and demolition landfills, including categories 9 – Leachate Collection; 11 – Groundwater Monitoring; 13 – Air Quality; 14 – Gas Control; and 17 – Cover.

Leachate Collection.

As set out in the regulations, a leachate collection system "shall be designed, constructed, maintained and operated to collect and remove leachate" from a sanitary or demolition landfill. Leachate generated by the sanitary or demolition landfill "shall be controlled on-site and not be allowed to discharge off the [landfill] property or discharge into the waters of the state, except in accordance with the approved plans and the Missouri Clean Water Law and corresponding rules. . . . The leachate collection systems specified by subsection (9)(B) shall be properly installed and operated in accordance with the permit and the approved design and plans and maintained for the thirty (30)-year post-closure care period, or as long as the department determines necessary." 10 CSR 80-3 (9).

The Inactive Landfill was closed in 1975, 22 years prior to the 1997 enactment of these leachate collection regulations and more than 30 years prior to issuance of this OU-2 FS Report. The regulations are not applicable to the Inactive Landfill.

Because the Inactive Landfill is a former sanitary landfill, the Missouri solid waste regulations may be relevant and appropriate. The RI Report, West Lake Landfill OU-2, revised September 2005 by Herst & Associates, Inc., confirms that six leachate risers (designated LR-100 through LR-105) were drilled and installed in areas where EPA inferred that industrial or hazardous wastes may have been disposed at the Inactive Landfill. In addition to this sampling of leachate from the Inactive Landfill, samples of leachate were collected from leachate risers previously installed in the Former Active Sanitary Landfill. A comparison was made between the leachate quality at the Inactive Landfill and the leachate quality at the Former Active Sanitary Landfill.

Based on that comparison, fewer organic compounds were present in the Inactive Landfill leachate and the organics that were detected were at lower concentrations than in the Former Active Sanitary Landfill leachate. No solvents were present in the Inactive Landfill leachate. In summary, data collected as part of the Remedial Investigation, including drilling into and through the Inactive Landfill areas identified as having contained standing water and collection and analysis of samples in the Inactive Landfill's presumed solvent disposal areas, did not confirm solvent disposal in the Inactive Landfill. Rather, it appears that the standing water identified in historic aerial photographs at the Inactive Landfill was associated with precipitation that had collected in low spots on the landfill.

Groundwater Monitoring.

"The owner/operator of a sanitary landfill shall implement a groundwater monitoring program capable of determining the sanitary landfill's impact on the quality of groundwater underlying the sanitary landfill." The regulation specifies that all "sanitary landfills permitted after October 9, 1993, shall be in compliance with all of the groundwater monitoring requirements of this section before an operating permit is issued."

Pre-1993 permitted sanitary landfills "shall be in compliance with section (11) –

- By October 9, 1994, if located less than one (1) mile from a drinking water intake (surface or subsurface);
- By October 9, 1995, if located between one (1) mile and two (2) miles from a drinking water intake (surface or subsurface); or

- By October 9, 1996, if located greater than two (2) miles from a drinking water intake (surface or subsurface). . . "

"Detection monitoring may continue into the closure and post-closure periods based on sampling frequency and parameters as determined on a site-by-site basis." 10 CSR 80-3 (11).

The Inactive Landfill had been closed for almost 20 years as of the 1993 adoption of these regulations. The regulations are not applicable to the Inactive Landfill.

Because the Inactive Landfill is a former sanitary landfill, the Missouri solid waste regulations may be relevant and appropriate. If groundwater monitoring detection requirements are used for the Inactive Landfill, sampling conducted as part of the RI identified a small area of shallow groundwater impact near the extreme southwest corner of the Inactive Landfill. The impacted groundwater near the Inactive Landfill exhibited sporadic detectable concentrations of petroleum hydrocarbons and VOCs. These detections do not appear to form a plume of contamination. The potential source of the impacts could be either a small area of the Inactive Landfill or, more likely, a leaking underground storage tank (LUST) site that is present just east of the Inactive Landfill, between the Inactive Landfill and the Former Active Sanitary Landfill.

Remedial Investigation groundwater samples were collected in 1995 and 1997. Supplemental groundwater sampling was conducted in 2003 and 2004. The supplemental sampling confirmed that the area of impacted groundwater is small and sporadic, and the concentrations are stable to declining. There are no current potential human receptors. There have been no identified surface water or sediment impacts. Any groundwater monitoring detection should address only this small area of shallow groundwater impact near the southwest corner of the Inactive Landfill.

Air Quality.

"The design, construction and operation of the [sanitary or demolition] landfill shall minimize environmental hazards and shall conform to applicable ambient air quality and source control regulations." *Effective dust control is required, and burning solid waste is the only expressly* prohibited activity. 10 CSR 80-3 (13).

There are no closure or post-closure air quality requirements in the Missouri regulations. Even if closure or post-closure air quality was regulated, no information suggests the Inactive Landfill presents problems with dust control or burning wastes. Any remediation or construction-related air quality issues will be addressed in the construction-related ARARs *section below.*

Gas Control.

"Decomposition gases generated within the [sanitary or demolition] landfill shall be controlled on-site, as necessary, to avoid posing a hazard to the environment or to public health and the safety of occupants of adjacent property."

"(C) Decomposition gases shall not be allowed to migrate laterally from the [sanitary or demolition] landfill to endanger public health and safety or to pose a hazard to the

environment. They shall be controlled on-site, flared or vented to the atmosphere directly through the cover, cut-off trenches or ventilation systems in a way that they do not accumulate in explosive or toxic concentrations, especially within structures. Decomposition gases shall not be allowed to concentrate above the following levels:

- Twenty-five percent (25%) of the lower explosive limit (LEL) or one and one quarter percent (1.25%) by volume for methane in buildings on the [sanitary or demolition] landfill property; and
- Fifty percent (50%) of the LEL or two and one-half percent (2.5%) by volume for methane in the soil at the property boundary of the [sanitary or demolition] landfill."

"Owners/operators of all [sanitary or demolition] landfills shall implement a methane monitoring program capable of detecting decomposition gas migration in the most likely zone(s) of migration, to ensure that the standards of paragraph (14)(C)2. of this rule are met." 10 CSR 80-3 (14).

The gas control regulations do not expressly provide for continuation into the closure and post-closure periods for sanitary landfills. The regulations are not applicable to the Inactive Landfill.

Because the Inactive Landfill is a former sanitary landfill, the Missouri solid waste regulations may be relevant and appropriate. If the regulations were to be applied to the Inactive Landfill, RI sampling identified the presence of landfill gas. Landfill gas monitoring along the western portion of the Inactive Landfill, immediately outside of the filled area, was conducted by advancing expendable sampling points to a depth of approximately 3.5 feet below ground surface at 10 locations. Gas samples were then collected using a peristaltic pump attached to polyethylene tubing that was attached to the sampling point. The sampling point was purged for a minimum of 20 minutes to draw landfill gas to the sampling point. Samples were then collected by pulling soil gas into a Tedlar bag. After the Tedlar bag sample was collected, a photoionization detector and combustible gas indicator were used to determine volatile organic compound (VOC), hydrogen sulfide, and combustible gas concentrations. Hydrogen sulfide was not detected in any of the samples. There were no combustible gases detected in 8 of the 10 samples. The remaining two locations exhibited combustible gas concentrations of 3% of the lower explosive limit (LEL) and 130% of the LEL. Eight of the 10 sample locations exhibited no VOCs. The remaining two locations exhibited VOC concentrations of 7.6 ppm and 10.1 ppm. These perimeter landfill gas monitoring results indicate sporadic, isolated landfill gas impacts near the Inactive Landfill.

Additional landfill gas characterization was performed by sampling and analysis of 10 landfill gas monitoring locations along the crest of the Inactive Landfill, in areas where gas would likely accumulate. The landfill gas monitoring was conducted by advancing expendable sampling points to a depth of approximately 3.5 feet below ground surface. Sampling methods were similar to those employed for the perimeter landfill gas characterization discussed above, except that landfill gas samples from the crest of the Inactive Landfill were collected in SUMMA canisters. Landfill gas results do not support the presence of widespread combustible gas within the Inactive Landfill, but landfill gasses will be addressed as part of the remedial action.

Cover.

Cover shall be applied to an operating landfill "to minimize fire hazards, infiltration of precipitation, odors and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance." The cover requirements are further subdivided into "satisfactory compliance – design" and "satisfactory compliance – operation" subcategories.

The cover – design subcategory requires that the written closure and post-closure plans submitted with a landfill permit application must specify "surface grades and side slopes needed to promote maximum runoff, without excessive erosion, to minimize infiltration." It further specifies that the final slope of the top of the landfill "shall have a minimum slope of five percent (5%)."

The cover – operations subcategory specifies that "surface grades and side slopes shall be maintained to promote runoff without excessive erosion." It further establishes criteria for the composition of final cover to be installed over landfill contents, followed within 180 days with vegetation. "The vegetation shall be established and maintained to minimize erosion and surface water infiltration," with re-grading and recovering as needed to maintain cover slope and integrity. 10 CSR 80-3.

The cover regulations are not applicable to the Inactive Landfill.

Existing cover for the Inactive Landfill complies with the Missouri design and operation standards that were in effect until 1997, and meet or come close to complying with the changed regulations promulgated in 1997 for today's current, permitted landfills. The majority of the landfill grounds have adequate precipitation runoff without signs of excessive erosion, and the landfill has adequate vegetation to maintain cover integrity.

In 1995, a cover evaluation was performed for the Inactive Landfill. As described in an August 1995 draft report prepared by Golder Associates Inc., 44 borings were drilled though the Inactive Landfill cover. The sampling locations were oriented in rows, running in a north-south direction at 200-foot intervals. Alternating rows were off-set 200 feet east-west and 100 feet north-south of the preceding row. Cover thickness was determined by pushing a sampling device into the soil using hydraulic impact. Samples were then extruded, and the cover thickness was measured. Portions of the samples were submitted for grain size analysis and other geotechnical properties. Undisturbed samples were also collected at selected locations for subsequent permeability testing. All borings were backfilled with low permeability bentonite chips to prevent seepage through the cap.

In 1992 the western slope of the Inactive Landfill was re-graded to achieve a 3:1 or less slope (instead of its prior 2:1 ratio). Although the top of this landfill does not meet a 5% grade requirement, it does, with a few exceptions, satisfy the 2% slope requirement that was the standard prior to 1997. Cap permeability at the Inactive Landfill ranges from 7×10^{-8} cm/sec to 1×10^{-5} cm/sec, with an average vertical permeability of 2.4×10^{-6} cm/sec. Landfill cap thickness ranges as high as 4.8 feet. Approximately 60% of the Inactive Landfill exhibits a cover thickness greater than 2 feet. The remainder of the Inactive Landfill cap exhibits a cover thickness of less than 2 feet.

The Missouri statutory and regulatory requirements for cover as part of landfill post-closure care may be relevant to the Inactive Landfill.

The existing cover composition and slope at the Inactive Landfill will achieve the goals intended by the Missouri requirements with minimal additional cover. MDNR regulations require cover for sanitary and demolition landfills to minimize fire hazards, infiltration of precipitation, odors and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance. Surface grades and side slopes are required as needed to promote maximum runoff without excessive erosion, so as to minimize infiltration. Cover composition includes specified levels of compacted clay, overlaid with soil and vegetation. Vegetation must be established after closure to minimize erosion and surface water infiltration, with re-grading and recovering as necessary to maintain cover slope and integrity.

Under the 1997 regulatory amendments, the final grade at the top of a landfill must have a minimum slope of 5%. As with the other Missouri regulatory requirements, the 5% slope rule does not apply to the Inactive Landfill because it ceased accepting waste approximately 22 years before the regulatory requirements were promulgated.

As for relevance and appropriateness, during conversations between Frank Dolan of MDNR and Evan Randall of Spencer Fane Britt & Browne, LLP (held April 24 and May 1, 2000), Mr. Dolan indicated that the purpose of the 5% minimum slope requirement was to address potential settlement of a landfill over time, which can allow the creation of depressions in the landfill surface that collect precipitation runoff and become areas of increased infiltration. Mr. Dolan further indicated that MDNR previously required a 2% slope on the surface of a landfill but, based on "common observations" of closed landfill settlement, MDNR subsequently determined that this slope angle was not great enough to prevent ponding of water.

In that conversation, Mr. Dolan referenced an article by Dean K. Wall and Chris Zeiss in the Journal of Environmental Engineering (Vol. 121, No. 3, March 1995), as the only formal document that MDNR used to select the 5% slope. In this article, the authors state that the process of differential settlement will take place within a 20 to 30 year period after a landfill is closed. The article does not address what the slope angle should be on the final surface of the landfill after settling.

EPA guidance documents provide further information about landfill closure and cover requirements, including slope guidelines. The guidance "Presumptive Remedies: CERCLA Landfill Caps RI/FS Data Collection Guide," EPA/540/F-95/009 (August, 1995) provides that "existing landfill caps should be evaluated to determine whether or not any components can be reused in the construction of a new cap. Use of existing components could save both time and money." Id. at 4. The top slope specified in this document is "3% to 5% minimum for drainage." Id.

EPA's guidance "Engineering Bulletin – Landfill Covers," EPA/540/S-93/500 (February, 1993), states that "covers are usually constructed in a crowned or domed shape with side slopes as low as is consistent with good runoff characteristics." Id. at 4. "When constructing a new landfill or when covering an existing landfill where the surface of the waste mass can be graded, EPA suggests that side slopes of a landfill cover not be less than 3 per cent or exceed 5 per cent." Id. at 5.

Based on the language of the Missouri sanitary and demolition landfill regulations, conversations with MDNR, and review of EPA guidance documents addressing new or remedial landfill construction on CERCLA sites, it appears that the purpose of minimum landfill slope requirements is to maximize precipitation runoff, minimize erosion, and diminish the creation of depressions on the surface of the landfill that allow ponding and infiltration of liquid into landfill contents. The Inactive Landfill existing top slope grades satisfy these goals, or can satisfy them with minimal additional cover or grading.

The surface grade slope on this part of the site meets MDNR's prior regulatory standard of at least 2%, and comes close to EPA's suggested grade standard of at least 3%. The top of the Inactive Landfill satisfies the underlying purpose of the grade requirements – it has sufficient slope to prevent erosion and promote runoff while, for the most part, minimizing the formation of depressions and ponding and allowing continued growth of vegetation.

The OU-2 RI Report indicates that a vigorous vegetative cover extends over the Inactive Landfill which, given the age of the landfill and the minimal risk presented by the site, should not be disturbed unless necessary to correct depressions. The Missouri regulations allow for re-grading and re-covering to maintain cover slope and integrity without re-capping an entire landfill to satisfy new grade requirements. 10 CSR 80-3.010(17)(C).

Further, the current status of the Inactive Landfill does not present the type of problem MDNR sought to fix with its change from a 2% top slope requirement to a 5% standard. MDNR was concerned about long-term settlement of landfill surfaces. This concern is appropriate for new landfills using refuse of various types and constituents as fill. Assorted refuse likely will settle at different rates, despite compaction at the time of disposal, and so a minimum slope of 5% at final cover is reasonable to allow for such differential settlement. These circumstances do not, however, present themselves at the Inactive Landfill.

Disposal activities in the Inactive Landfill ceased in 1975 – more than 30 years ago. Any differential settlement on the surface of the landfill has long subsided. The Missouri regulations allow, and the CERCLA remedial action can include, re-grading, correction, and re-vegetation of deficient portions of the landfill cover without requiring wholesale construction of a new landfill cap.

2.1.4.3 Construction-Related Regulatory Requirements – Missouri Air Quality Regulations, Missouri Storm Water Discharge and Management Regulations, and Missouri Groundwater Extraction or Monitoring Well Construction Code,

The CERCLA presumptive remedy for municipal landfills assumes that a Subtitle D landfill cap will be installed and maintained over the Inactive Landfill. Because the current Inactive Landfill cap does not meet Missouri state slope, grade and cover requirements, additional slope and grading work must be done and cover materials added to the landfill to achieve the regulatory requirements and this work must satisfy Missouri air quality regulations, including protection against radionuclides. Any construction work also will be subject to storm water discharge and management requirements. To the extent work on the Inactive Landfill portion of the site brings workers or other persons close to the ionizing radiation sources present at OU-1, appropriate health and safety measures will be implemented to protect on-site personnel. Finally, additional monitoring wells may be installed at the Inactive Landfill for long-term operation and maintenance, and this will require compliance with Missouri monitoring well construction codes.

Ambient Air Quality.

The Inactive Landfill is located in St. Louis County. Ambient air quality in St. Louis County is subject to the general Missouri state air quality regulations set out at 10 C.S.R. Part 10-6.010 *et seq.*, and the St. Louis County-specific regulations found at 10 C.S.R. Part 10-5.010 *et seq.* These regulations:

- require construction permits for the control of criteria pollutants, volatile organic compounds (VOCs), oxides of nitrogen, and hazardous air pollutants (HAPs) from operating facilities which emit or may emit more than the *de minimis* threshold amounts of such regulated pollutants (10 C.S.R. Part 10-6.010 and 6.060);

- call for the use of reasonable control measures to prohibit the release of fugitive particulates past a property boundary (10 C.S.R. Part 10-6.170);

- specify the maximum allowable opacity for visible air emissions from any source of regulated air pollutants (10 C.S.R. Part 10-6.220);

- restrict objectionable odors on or adjacent to real property used for designated purposes (10 C.S.R. Part 10-5.160); and

- require monitoring and, under certain circumstances, gas collection and control for non-methane organic compounds from St. Louis County municipal solid waste landfills which accepted waste or had additional capacity to accept waste after November 8, 1987 (10 C.S.R. Part 10-5.490).

The OU-2 Remedial Investigation plan and results were reviewed and approved by USEPA. and MODNR. The RI did not identify the presence or release of hazardous air pollutants at the Inactive Landfill, either under the federal National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations (40 C.F.R. Part 61.01 and 61.02) or Missouri regulations. The only HAP present at the West Lake Landfill site is radionuclides, and all radiological materials are being addressed under the OU-1 RI/FS process.

With regard to the non-methane organic compound gas collection and control regulation, these requirements are not applicable to a closed landfill which ceased accepting waste prior to November 8, 1987 and which was never subject to the gas collection and control regulations. These requirements could be relevant and appropriate if the Inactive Landfill was a source of non-methane organic compounds. To the extent the remedial design activities identify a problem with non-methane organic gas compounds, this regulation may become relevant and appropriate. Further, any landfill gas sampling needed for the remedial design or remedial construction will comply with current Missouri landfill gas sampling and management regulations.

All of the remaining construction-related air quality regulations will be considered and addressed in the health and safety plans for remediation and construction activities concerning the Inactive Landfill including, for example, particulate emission controls, and appropriate monitoring (as specified in 19 C.S.R. 20-10.040) and, if necessary, protection for workers and others potentially exposed to ionizing radiation at OU-2 during activities conducted near the OU-1 portions of the overall site.

Storm Water Discharge and Management.

The Missouri regulations governing storm water discharge and management at construction sites are set out at 10 C.S.R. Part 20-6.200. To the extent that the remedial action activities for the Inactive Landfill require the disturbance of more than one (1) acre of the landfill and the creation of a storm water point source, these regulations will be applicable to such activities and may require pre-construction permitting and implementation of best management practices, unless otherwise exempted as a landfill approved by MDNR for closure under 20-6.200(1)(B)10.

It is likely that Inactive Landfill storm water can be collected and handled by the same Former Active Sanitary Landfill systems which address storm water under that landfill's general storm water permit.

Groundwater Extraction or Monitoring Well Construction.

The Missouri regulations governing groundwater extraction or monitoring well construction are set out at 10 C.S.R. Part 23-4.010 *et seq.* To the extent that remedial design or remedial action activities for the Inactive Landfill require the installation of new extraction or monitoring wells, these regulations will be applicable to those activities.

2.1.4.4 Missouri Landfill Post-Closure Care and Corrective Action Plans

Missouri regulates the construction, closure and post-closure of solid waste disposal areas at 10 C.S.R. Part 80-2.030. Unpermitted facilities such as the Inactive Landfill are required to remove unlawfully deposited solid waste or compact or cover the solid waste with soil, or both, establish vegetation, and register the site as an unpermitted solid waste disposal area by recording a notice of same in the property chain of title with the local recorder of deeds. 10 C.S.R. Part 80-2.030 (2)(A) & (B).

If a person seeks approval from MDNR to construct a solid waste disposal facility, the application to construct such a site must include a closure plan and a thirty (30) year post-closure plan. 10 C.S.R. Part 80-2.030 (4). Further, if corrective action is required for a permitted sanitary landfill, the owner or operator of such facility is required to post financial assurance sufficient to fund the required corrective action. 10 C.S.R. Part 80-2.030 (4)(C).

Because the Inactive Landfill ceased accepting waste in 1975, the closure, post-closure and corrective action provisions of the Missouri regulations are not applicable. The closure and post-closure care regulations may nonetheless provide a useful framework and set of standards for the operation and maintenance components of a post-construction, post-closure and corrective action plan for the Inactive Landfill. The Inactive Landfill should also be registered as an unpermitted facility, and record a notice of same in the property chain-of-title.

3.0 RESPONSE ACTION OBJECTIVES

A 1993 document titled Presumptive Remedy for CERCLA Municipal Landfill Sites (EPA 540-F-93-035 (EPA, 1993a)) provides guidance for the development of remedial action objectives (RAOs) for OU-2 of the West Lake Landfill. The referenced document states that RAOs should be developed on the basis of pathways identified for action in the site conceptual model. The site conceptual model was presented in the RI Report (revised 2005), and was further evaluated in the Baseline Risk Assessment Report (revised 2005).

Containment is the presumptive remedy for CERCLA municipal landfill sites. Application of the Presumptive Remedy approach was approved in the West Lake Landfill OU-2 AOC, and data collected and evaluated as part of the RI/FS process support the use of the Presumptive Remedy approach toward alternatives development for the Inactive Landfill. As described in the Presumptive Remedy guidance, use of the Presumptive Remedy eliminates the need for the initial identification and screening of alternatives during the feasibility study because EPA has found that certain technologies are routinely and appropriately screened out on the basis of effectiveness, feasibility, or cost. As part of the West Lake Landfill OU-2 RI/FS, a Remedial Action Objectives report was prepared and subsequently approved by EPA, to form the basis for this Feasibility Study Report.

As described in the Baseline Risk Assessment Report, plausible human receptors include on-site workers such as groundskeepers and transients/trespassers and nearby commercial/industrial workers. The nearest current permanent residence is approximately one-fourth of a mile from OU-2. Under future scenarios, plausible on-site human receptors include trespassers or workers such as a groundskeeper. As described in the Baseline Risk Assessment Report, the reasonable expected future use of the site will be industrial or commercial, and there will be no future residential use. Plausible future off-site receptors include off-site workers at surrounding commercial/industrial facilities. There is a potential for groundwater to move off-site where it could be used by future residential receptors located off-site of the landfill.

The Presumptive Remedy for CERCLA Municipal Landfill Sites lists typical primary RAOs, including:

- Preventing direct contact with landfill contents;
- Minimizing infiltration and resulting contaminant leaching to ground water;
- Controlling surface water runoff and erosion;
- Collecting and treating contaminated ground water and leachate to contain the contaminant plume and prevent further migration from the source area; and
- Controlling and treating landfill gas.

Non-Presumptive Remedy Remedial Action Objectives include:

- Remediating ground water;
- Remediating contaminated surface water and sediments; and
- Remediating contaminated wetland areas.

The following sections discuss the application of presumptive and non-presumptive remedy remedial action objectives to the Inactive Landfill. The following sections address the presumptive and non-presumptive remedies via the following criteria:

- Preventing direct contact with landfill contents, minimizing infiltration and resulting contaminant leaching to groundwater, and controlling surface water runoff and erosion – Cover Evaluation.
- Collecting and treating contaminated ground water and leachate to contain the contaminant plume and prevent further migration from the source area; remediating groundwater – Leachate and Groundwater Characterization.
- Controlling and treating landfill gas – Landfill Gas Characterization.
- Remediating contaminated surface water and sediments and remediating contaminated wetlands – Surface water, Sediments, and Wetlands Evaluation.

Cover Evaluation

As described in a February 1991 EPA document titled Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA/540/P-91-001), the objectives of a landfill cap investigation are to:

- Determine the approximate thickness, composition, and horizontal extent of the existing cap.
- Determine if any hot spots of soil contamination are present in the existing cap and characterize these hot spots to the extent necessary to determine whether soils can be covered and left in the landfill or whether the hot spots need to be excavated and separately remediated for source control.
- Document the integrity of the existing cap (e.g., determine if roots have penetrated through the cap) and determine the geotechnical and other relevant properties of the existing cap if the existing cap was engineered and will be an integral part of the final cover system).
- Evaluate potential differential settlement (total and differential) of the landfill and the final cover system that will be placed on the landfill.
- Evaluate the stability of any slopes and the capacity of the waste to support the final cover systems and any surficial loadings such as those from vehicular traffic or construction equipment.

Approximate Thickness, Composition, and Horizontal Extent of the Existing Cap

The Inactive Landfill area has a cover that does not meet applicable or relevant and appropriate regulations. In 1995, a cover evaluation was performed for the Inactive Landfill. As described in an August 1995 draft report prepared by Golder Associates Inc., 44 borings were drilled though the Inactive Landfill cover. The sampling locations were oriented in rows, running in a north-south direction at 200-foot intervals. Alternating rows were off-set 200 feet east-west and 100 feet north-south of the preceding row. Cover thickness was determined by pushing a sampling device into the soil using hydraulic impact. Samples were then

extruded, and the cover thickness was measured. Portions of the samples were submitted for grain size analysis and other geotechnical properties. Undisturbed samples were also collected at selected locations for subsequent permeability testing. All borings were backfilled with low permeability bentonite chips to prevent seepage through the cap.

According to 10 CSR 80-3.010(17)(C).4.A., the final cover at landfills without liners (such as the Inactive Landfill), shall consist of a 2-foot thick layer of compacted clay with a permeability of less than 1×10^{-5} cm/sec, overlain with a 1-foot thick layer of topsoil. Grain size analyses showed the Inactive Landfill cap material to be predominantly fine-grained material. Based on the cover evaluation, the Inactive Landfill cap permeability ranged from 7×10^{-8} cm/sec to 1×10^{-5} cm/sec, with an average vertical permeability of 2.4×10^{-6} cm/sec. Landfill cap thickness ranged as high as 4.8 feet. Approximately 60% of the Inactive Landfill exhibited a cover thickness greater than 2 feet. The remainder of the Inactive Landfill cap exhibited a cover thickness of less than 2 feet. None of the sampling locations exhibited topsoil of 1 foot or more.

Based on the data, an upgrade to the Inactive Landfill cap is needed to meet applicable or relevant and appropriate regulations, including placement of additional low permeability soil or other low permeability cover material in a portion of the Inactive Landfill area to achieve minimum thickness requirements, plus the addition of 1 foot of topsoil across the entire Inactive Landfill. A reduction in infiltration is considered desirable to reduce the potential for the Inactive Landfill to act as a source.

Hot Spots

The Presumptive Remedy guidance includes a decision matrix to determine the need for hot spot treatment as part of the alternatives development and screening process. As stated in the guidance, the overriding question is whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place. The guidance provides a listing of four questions, the answers to which determine the need for hot spot treatment. It is important to note that the Presumptive Remedy guidance states that all four questions must be answered in the affirmative for hot spot treatment to be warranted. The four questions are as follows:

- Does evidence exist to indicate the presence and approximate location of waste?
- Is the hot spot known to be principal threat waste?
- Is the waste in a discrete, accessible part of the landfill?
- Is the hot spot known to be large enough that its remediation will reduce the threat posed by the overall site but small enough that it is reasonable to consider removal (e.g., 100,000 cubic yards or less)?

The data collected as part of the RI/FS did not indicate the presence of one or more hot spots within the Inactive Landfill waste mass. Leachate risers were installed in areas inferred by the EPA to represent potential liquid waste disposal locations, and samples of liquids were obtained to evaluate the presence/absence of potential solvent waste disposal and for comparison to leachate quality at the Former Active Sanitary Landfill. Based on the comparison, fewer organic compounds were present in the Inactive Landfill leachate and the organics that were detected were at lower concentrations than in the Former Active Sanitary

Landfill leachate. No solvents were present in the Inactive Landfill leachate. In summary, data collected as part of the RI, including drilling into and through the identified standing water areas and collection and analysis of samples in the presumed solvent disposal areas, did not confirm solvent disposal in the Inactive Landfill. Rather, it appears that the standing water identified in historic aerial photographs was associated with precipitation that had collected in low spots on the landfill cap. Based on the RI characterization activities, there are no hot spots within the Inactive Landfill, and the answer to the first question is negative. Given the lack of hot spots, questions 2, 3, and 4 are not applicable to West Lake Landfill OU-2. None of the four questions are answered affirmatively, and a determination is therefore made that hot spot treatment is not applicable to West Lake Landfill OU-2.

Integrity of the Existing Cap

Various geotechnical properties were evaluated as part of cap investigation conducted in 1995 (Golder Associates Inc., 1995), including Atterberg Limits, Grain Size Distribution with Hydrometer, Standard Proctor moisture-density, natural moisture content, in-situ permeability, and remolded permeability. The cap was observed to support vegetative growth, but exhibited a potential for erosion. The geotechnical properties are considered appropriate for integration of the existing cover with an upgraded cover.

Potential Total and Differential Settlement

The Inactive Landfill ceased accepting wastes approximately 30 years ago. Accordingly, there is little likelihood of future significant settlement, either as total or differential settlement.

Slope Stability and Capacity to Support the Final Cover Systems and Surficial Loadings

In 1992 the western slope of the Inactive Landfill was regraded to achieve a 3:1 or less slope (instead of its prior 2:1 ratio). Although the top of this landfill does not meet a 5% grade requirement, it does, with a few exceptions, satisfy the 2% slope requirement that was the standard prior to 1997. The Inactive Landfill can support a modified final cover system and any surficial loadings such as those from vehicular traffic or construction equipment during cover enhancements that might be made as part of the remedial activities. Based on the language of the Missouri sanitary and demolition landfill regulations, conversations with MDNR, and review of EPA guidance documents addressing new or remedial landfill construction on CERCLA sites, it appears that the purpose of minimum landfill slope requirements is to maximize precipitation runoff, minimize erosion, and diminish the creation of depressions on the surface of the landfill that allow ponding and infiltration of liquid into landfill contents. The Inactive Landfill existing top slope grades satisfy these goals, or can satisfy them with minimal additional cover or grading.

Leachate

As described in a February 1991 EPA document titled Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA/540/P-91-001), the objectives of leachate investigations are to:

- Determine location of leachate seeps.
- Determine chemical characteristics of leachate.

- Locate potential source areas (in situations where there are no known or suspected hot spots, the entire landfill may be considered a source).
- Determine leachate impact on groundwater.

The RI did not identify leachate seeps associated with the Inactive Landfill. As described in the RI Report, six leachate risers designated LR-100 through LR-105 were drilled and installed in areas where EPA inferred that industrial and/or hazardous wastes might have been disposed. In addition to sampling leachate from the Inactive Landfill, samples of leachate were collected from leachate risers previously installed in the Former Active Sanitary Landfill. A comparison was made between the leachate quality at the Inactive Landfill and the leachate quality at the Former Active Sanitary Landfill. Based on that comparison, fewer organic compounds were present in the Inactive Landfill leachate and the organics that were detected were at lower concentrations than in the Former Active Sanitary Landfill leachate. No solvents were present in the Inactive Landfill leachate. In summary, data collected as part of the RI, including drilling into and through the identified standing water areas and collection and analysis of samples in the presumed solvent disposal areas, did not confirm solvent disposal in the Inactive Landfill. Rather, it appears that the standing water identified in historic aerial photographs was associated with precipitation that had collected in low spots on the landfill.

Construction of an improved landfill cap will likely reduce the potential for the Inactive Landfill to act as a continuing source of impacts to the shallow groundwater near the southwestern corner, if the Inactive Landfill is the source of such impacts instead of the nearby LUST site. Furthermore, because the Inactive Landfill is not lined, leachate collection is not technically feasible. Based on these factors, leachate collection and treatment is not considered a viable alternative and is excluded from further evaluation.

Groundwater

As discussed in the Decision Tool for Landfill Remediation dated August 1999 (Boyer, et al., 1999), prepared for the Air Force Center for Environmental Excellence, groundwater controls may be needed if either of the following conditions apply:

- Lateral groundwater flow can leach contaminants from the wastes directly into groundwater.
- Surface water infiltration through the cover can leach contaminants from the wastes and contaminate groundwater.

Data indicate that the Inactive Landfill was constructed directly on the pre-existing ground surface. Accordingly, there is little likelihood of lateral groundwater flow leaching contaminants directly from the buried waste into groundwater. Surface water infiltration has been controlled by the existing Inactive Landfill cover, and the Presumptive Remedy assumes containment as a key component of the remedial alternative to reduce surface water infiltration.

Sampling conducted as part of the RI identified a small area of shallow groundwater impact near the extreme southwest corner of the Inactive Landfill. The impacted groundwater near the Inactive Landfill exhibited detectable concentrations of petroleum hydrocarbons and VOCs. The Baseline Risk Assessment confirmed that the identified concentrations represent

a potential current and/or future health risk. As detailed in the RI Report, the potential source of the impacts could be either a small area of the Inactive Landfill or a leaking underground storage tank (LUST) site that is present just east of the Inactive Landfill, between the Inactive Landfill and the Former Active Sanitary Landfill.

Remedial Investigation groundwater samples were collected in 1995 and 1997, with supplemental groundwater sampling conducted in 2003 and 2004. The supplemental sampling confirmed that the area of impacted groundwater is small and the concentrations are stable to declining. There are no current potential human receptors. As detailed below, there have been no identified surface water or sediment impacts. Based on the overall site characterization, groundwater remediation is not indicated. Landfill cap upgrades to include additional low permeability soil, placement of topsoil, and subsequent vegetative cover to promote evapotranspiration are anticipated to address potential localized impacts from the Inactive Landfill by reducing the potential for the Inactive Landfill to act as a source. If the groundwater impacts are a result of the LUST site, corrective actions anticipated to be performed as part of the LUST site remedial effort will address the localized impacts by eliminating the source. It is recommended that long-term groundwater monitoring near the western boundary of the Inactive Landfill be evaluated as part of the remedial design phase of the project to allow verification of shallow groundwater quality improvement through time as a result of either the Inactive Landfill cover improvement or the LUST corrective actions.

It also is recommended that continued groundwater monitoring near the Inactive Landfill be included in the remedy for Inactive Landfill.

Landfill Gas Characterization

As described in a February 1991 EPA document titled Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA/540/P-91-001), the objectives of a landfill gas investigation are to:

- Perform an assessment of human health risks due to air toxics and explosive hazards.
- Evaluate the feasibility of gas collection and treatment.
- Evaluate other remedial actions.

Air sampling was conducted during investigative activities associated with the Inactive Landfill, and the results indicate no human health risks from air toxics or explosive hazards.

Sampling identified the presence of landfill gas in the Inactive Landfill. Landfill gas monitoring along the western portion of the Inactive Landfill, immediately outside of the filled area, was conducted by advancing expendable sampling points to a depth of approximately 3.5 feet below ground surface at 10 locations. Sampling methodologies were consistent with approved procedures described in the RI/FS Work Plan (Golder Associates Inc., 1995). Gas samples were collected using a peristaltic pump attached to polyethylene tubing that was attached to the sampling point. The sampling point was purged for a minimum of 20 minutes to draw landfill gas to the sampling point. Samples were then collected by pulling soil gas into a Tedlar bag. After the Tedlar bag sample was collected, a photoionization detector and combustible gas indicator were used to determine volatile organic compound (VOC), hydrogen sulfide, and combustible gas concentrations. Hydrogen sulfide was not detected in

any of the samples. There were no combustible gases detected in 8 of the 10 samples. The remaining two locations exhibited combustible gas concentrations of 3% of the lower explosive limit (LEL) and 130% of the LEL, respectively. Eight of the 10 sample locations exhibited no VOCs. The remaining two locations exhibited VOC concentrations of 7.6 ppm and 10.1 ppm, respectively. The perimeter landfill gas monitoring results indicate sporadic, isolated landfill gas impacts near the inactive landfill.

Additional landfill gas characterization was performed by sampling and analysis of 10 landfill gas monitoring locations along the crest of the Inactive Landfill, in areas where gas would likely accumulate. The landfill gas monitoring was conducted by advancing expendable sampling points to a depth of approximately 3.5 feet below ground surface. Sampling methods were similar to those employed for the perimeter landfill gas characterization discussed above, except that landfill gas samples from the crest of the Inactive Landfill were collected in SUMMA canisters. Landfill gas results do not support the presence of widespread combustible gas within the Inactive Landfill. The Inactive Landfill does not currently incorporate either a passive landfill gas venting system or an active landfill gas collection system.

As described in a February 1991 EPA document titled Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA/540/P-91-001), constructing an active landfill gas collection and treatment system should be considered where (1) existing or planned homes or buildings may be adversely affected through either explosion or inhalation hazards, (2) final use of the site includes allowing public access, (3) the landfill produces excessive odors, or (4) it is necessary to comply with ARARs. There are no existing or planned homes or buildings that may be adversely affected through explosion or inhalation hazards, the final use of the Inactive Landfill does not include public access, the Inactive Landfill does not produce excessive odors, and installation of an active landfill gas collection system is not an ARAR for the Inactive Landfill. It is recommended that the installation of a passive landfill gas venting system in the Inactive Landfill be further evaluated as part of the remedial design phase of the project, along with installation of a perimeter landfill gas monitoring system consistent with current regulations, to provide long-term data regarding potential landfill gas migration.

Surface Water, Sediment, and Wetlands Characterization

Surface water and sediment samples were collected from the Earth City Stormwater Retention Pond, located immediately west of the Inactive Landfill. Samples were analyzed for the same constituents as groundwater samples. Based on the sampling results, the OU-2 area, including the Inactive Landfill, is not contributing measurable impacts to the Earth City Stormwater Retention Pond.

There are no identified wetlands on the Inactive Landfill.

The Inactive Landfill currently does not have an NPDES permit. However, available data suggests that stormwater runoff from the Inactive Landfill moves toward existing outfall 003 before exiting the site. The alternatives evaluated will include the establishment of runoff sampling points based on final topography and cover slopes along with resultant drainage patterns. Sampling of nearby surface water and sediments confirms that there has been no measurable impact to the adjacent surface water or sediments. After completion of the

remedy for the Inactive Landfill, a runoff monitoring program should be developed based on final landfill contours to provide data supporting the lack of runoff-induced impacts.

Summary: Inactive Landfill

The Inactive Landfill is more than thirty years old and is not subject to a formal regulatory program, and accordingly has no current or future regulatory compliance framework that would be considered equivalent to the presumptive remedies and/or non-presumptive remedies applicable or relevant and appropriate to the West Lake Landfill OU-2. The current cover on the Inactive Landfill does not appear to comply with final cover requirements, landfill gas has been detected sporadically in perimeter monitoring locations, and shallow groundwater impacts have been observed in a localized area near the Inactive Landfill at concentrations that support the need for limited remedial actions based on the Baseline Risk Assessment. Accordingly, the Feasibility Study includes an evaluation of alternatives designed to upgrade the landfill cover to meet regulatory requirements, which in turn are anticipated to reduce the potential for the Inactive Landfill to act as a source. In addition, the evaluated Feasibility Study alternatives include the establishment of runoff monitoring locations, to be based on the final cover topography and resultant drainage patterns. Perimeter landfill gas monitoring and groundwater monitoring are also recommended, along with institutional controls.

4.0 GENERAL RESPONSE ACTIONS

General response actions describe those actions that will satisfy the RAOs. General response actions may include no action, containment, excavation, extraction, disposal, treatment, institutional controls, monitoring, or a combination of these. Based on the RAOs and ARARs for West Lake Landfill Operable Unit 2, the following general response actions are considered applicable in order to meet the presumptive remedy guidelines:

- No action
- Containment
- Institutional Controls
- Monitoring

For each general response action, broad technology groups and specific process options that could be used to implement the actions are identified. Technologies refer to general types of actions (e.g., capping). Process options refer to specific processes within each technology group (e.g., soil cover). Figure 4-1 presents a list of general response actions, technology group, and process options. Figure 4-1 and the following discussion have been developed for consistency with the general response action evaluation provided for Operable Unit 1, to allow direct comparisons. The information presented on Figure 4-1 was used to develop a listing of potentially applicable technologies through a screening process that eliminated the following: advisories as institutional controls; physical treatment/pretreatment in-situ (dewatering/drying, non-thermal extraction, and thermal destruction); chemical treatment/pretreatment in-situ (soil flushing and stabilization/solidification); excavation; and, off-site disposal. The list of screened technologies and the resultant list of potentially applicable technologies (Figure 4-2) are similar to the West Lake OU-1 technologies, with the exceptions of excavation and off-site disposal. Whereas OU-1 had particular conditions that supported the retention of excavation and off-site disposal as a potentially applicable technologies, OU-2 conditions do not support excavation or off-site disposal as potentially applicable technologies.

The list of retained technologies includes institutional controls, access restrictions, monitoring, and in-situ containment.

EPA defines institutional controls as non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. In accordance with the NCP (EPA, 1990), institutional controls are generally used in conjunction with, rather than in lieu of, engineering remedies. Where the opportunity exists, institutional controls should be "layered" (i.e., use multiple institutional controls) or implemented in a series to provide overlapping assurances.

EPA recognizes four categories of institutional control mechanisms:

1. Proprietary Controls - these controls are based on state property law with the most common examples being easements and covenants;

2. Governmental Controls - these controls use the authority of an existing unit of government such as zoning and building codes;

3. Enforcement and Permit Tools - these legal tools include orders, permits and consent decrees; and

4. Informational Devices - these devices include deed notices and State registries or advisories.

Institutional controls are measures that minimize public exposure by limiting access to or use of contaminated areas. Institutional controls are effective as informational devices and can constitute an enforceable property interest, but institutional controls do not preclude access to or use of property. Institutional controls do not reduce contaminant toxicity, mobility, or volume, but they can reduce the potential for exposure to contaminated material. Institutional controls, such as land use covenants, and limitations on groundwater use, are used as appropriate to supplement engineering controls such as fencing or containment to prevent or limit exposure to affected environmental media and/or to ensure the effectiveness of other response actions. Institutional controls can include both on-site and off-site institutional controls.

Property use restrictions at the West Lake Landfill Site will be implemented through the placement of institutional controls. The specific institutional control design and implementation strategy will be a component of the remedial design planning process following release of the OU-2 Record of Decision by EPA. Where appropriate, multiple mechanisms, or a "layered" approach, will be used to enhance the effectiveness of the institutional control strategy. See above for the general categories of institutional control mechanisms.

At the West Lake Landfill Site, the affected properties are privately owned and the use restrictions must be maintained for a long period of time. Therefore, proprietary controls should be considered because they generally run with the land and are enforceable. The primary examples of proprietary controls, covenants and easements, are based in real property law and generally create legal property interests. This involves placing a legal instrument in the chain of title of the property. A property interest may be conveyed from the property owner (grantor) to a second party (grantee) for the purpose of restricting land or resource use. These types of controls can be binding on subsequent purchasers of property giving them a measure of long-term reliability.

Covenants under common law are typically promises to do something (affirmative) or not to do something (negative) with regard to the land. In case of a breach of the covenant, contract law usually applies. This means that the available remedies in case of a breach of the covenant would generally be limited to monetary damages.

Restrictive covenants may be an effective tool for implementing and enforcing the use restrictions established as part of the remedy for the West Lake Landfill Site. Easements, allowing the easement holder to enter or use property for a stated purpose, could be useful for adjacent property, e.g., the Crossroad property, to secure access rights for any long-term monitoring or maintenance needs.

The institutional control component (Appendix E) of the MDNR CALM draft regulations consists primarily of a restrictive covenant with an easement provision that allows MDNR access to a site for the duration of the restrictive covenant for the purpose of conducting periodic inspections. As grantee, MDNR has the authority to enforce the restrictive covenant. CALM Appendix E requires that the restrictive covenant state the intention of the property

owner to make the covenant and the easement effective in perpetuity or until the MDNR determines that they are no longer necessary. This type of language ensures that a court will interpret the restrictive covenant and easement to run with the land and be binding on a current owner and all subsequent owners of the property, regardless of any case law that might support a different conclusion. As such, the CALM Appendix E language provides a useful format for implementing use restrictions at the West Lake Landfill site, including the requirement that a property owner sign and record the restrictive covenant with the Recorder's Office in the county in which the property is located.

In addition to the above proprietary controls, the MDNR has promulgated regulations pertaining to the location and construction of water wells. The Well Construction Code (10 C.S.R. 23-3.010) prohibits the placement of a well within 300 feet of a landfill. These rules should provide an additional layer of protection against the placement of wells on or near the West Lake Landfill.

Also, the West Lake Landfill site has been listed by MDNR on the State's Registry of Confirmed, Abandoned, or Uncontrolled Hazardous Waste Disposal Sites in Missouri (Registry). The Registry is maintained by the MDNR pursuant to the Missouri Hazardous Waste Management Law, Mo.Rev.Stat. Section 260.440. Sites listed on the Registry appear on a publicly available list. A notice is filed with the County Recorder of Deeds and notice must be provided by the seller to any potential buyers of the property.

The remedial design Work Plan will contain an institutional control design and implementation plan specifying the institutional controls and identifying the steps necessary to implement proprietary controls. At a minimum, the controls will provide detailed descriptions of the types and locations of the residual contaminants, the parties involved, provisions for third party enforcement, the parties' rights, the resource/use restrictions, language to assure that the institutional controls are binding on subsequent purchasers, and specific notice and approval requirements for modifying or terminating a control. Title documentation also generally will be required.

The Operation and Maintenance (O&M) Plan will contain procedures for surveillance, monitoring and maintenance of the institutional controls. The O&M Plan will provide for notice to EPA and/or the state of any institutional control violations, planned or actual land use changes, and any planned or actual transfers, sales or leases of property subject to the use restrictions.

The use restrictions or institutional controls objectives described below apply to all alternatives meeting the Subtitle D cover system requirements (i.e., 2, 3 and 4). These restrictions must be maintained until the Site is released for unlimited use. These use restrictions do not apply to activities related to the implementation, maintenance, monitoring or repair of the remedy.

These use restrictions should apply to the entirety of OU-2 – the Former Active Sanitary Landfill, the Demolition Landfill and the Inactive Landfill.

1. Prevent development and use for residential housing, schools, childcare facilities or playgrounds.

2. Prevent development and use for industrial or commercial purposes, such as manufacturing, offices, storage units, parking lots or other facilities, that are incompatible with the function or maintenance of the landfill cover.

3. Prevent construction activities involving drilling, boring, digging, or other use of heavy equipment that could disturb vegetation, disrupt grading or drainage patterns, cause erosion or otherwise compromise the integrity of the landfill cover, or manage these activities such that any damage to the cover is avoided or repaired.

4. Prevent the use of all groundwater underlying these areas.

5. Retain access necessary for continued maintenance, monitoring, inspections and repair.

Use restrictions for adjacent disposal areas, including OU-1 Areas 1 and 2, the Buffer Zone and the Crossroads Property, will be identified under the West Lake Landfill OU-1 Feasibility Study. Coordination across operable units will ensure that use restrictions are complementary.

Access restrictions generally involve physical barriers to entry such as fences and guards and are intended to limit casual access to the particular areas. A fence currently exists along the outside boundary of the Inactive Landfill, along the length of Old St. Charles Rock Road. Access to the Inactive Landfill is further limited by fencing and gates which surround the entire industrialized complex, including the Former Active Sanitary Landfill, Demolition Landfill, asphalt plant, concrete plant, and OU-1 areas. Monitoring can be used to evaluate the effectiveness of any technology employed. Finally, in-situ containment consists of technologies that are used to address potential sources of impacts without removing the contaminants or potential source areas from the ground. As described in the West Lake OU-1 FS Report (Engineering Management Support, Inc., 2006), in-situ containment technologies include surface controls/diversions, surface water/sediment control barriers, dust controls, and caps/covers. Surface controls/diversions are used to divert surface runoff around contaminated areas to minimize the potential for surface water contact with impacts soils. Graded contours, swales, and berms can effectively control surface water runon and runoff. A contaminated area can be encapsulated by placing low permeability surface barriers such as covers on top of an area. A variety of materials can be used in covers, including soils, admixtures, and synthetic membranes. For the Inactive Landfill, asphalt and concrete covers were screened out because of potential cost and maintenance requirements.

Under the Presumptive Remedy approach, and based on site condition, containment is a key component for any remedial actions to be undertaken at the Inactive Landfill portion of West Lake Landfill OU-2. There are several technologies that are routinely utilized to provide containment at landfills:

- Subtitle D-prescribed Soil Cover
- MDNR-prescribed Soil Cover
- Geosynthetic Clay Cover
- Subtitle C-prescribed Cover
- Alternative Covers

An MDNR-prescribed soil cover includes a low-permeability layer overlain by a topsoil layer to promote vegetative growth. Under Missouri Solid Waste Regulations (10 CSR 80-3.01(17)), the low permeability layer is to be a minimum of 2 feet of clay with a permeability of not more than 1×10^{-5} cm/sec, overlain by a minimum of 1 foot of topsoil capable of sustaining vegetative growth. An MDNR-prescribed soil cover would most completely meet ARARs. Accordingly, an MDNR-prescribed cover is carried forward to the development and evaluation of alternatives. The other technologies listed above are not carried forward, given that they would not completely meet ARARs.

5.0 DEVELOPMENT OF ALTERNATIVES

Given the applicability of the Presumptive Remedy approach to the Inactive Landfill portion of West Lake OU-2, containment is the preferred remedy, with appropriate modifications as necessary to address the remaining RAOs described above combined with institutional controls. The previously-submitted and EPA-approved RAO Memorandum detailed the various evaluations that were used to narrow the applicable response actions to the following as they relate to the Inactive Landfill:

- Landfill cover improvement
- Establishment of runoff monitoring locations
- Continued groundwater monitoring

The RAO Memorandum recommended additional data collection activities in perimeter landfill gas monitoring locations during the remedial design phase to further clarify the need for landfill gas venting/collection via either passive vents or an active landfill gas collection system.

Based on the aforementioned response action objectives and the regulatory preference for containment accompanied by institutional controls, the following alternatives have been developed, including the No Action alternative:

- Alternative 1 – No Action
- Alternative 2 – MDNR-Prescribed Cover With Long-Term Monitoring and Institutional Controls

5.1 Alternative 1 – No Action

The No Action alternative is included as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300) to serve as a baseline for comparison to other alternatives. Under this alternative, no engineering measures would be implemented to reduce potential exposures or control potential migration from the Inactive Landfill. No monitoring would be conducted to identify or evaluate any potential changes that may occur in various environmental media.

Existing proprietary use institutional controls consist of restrictive deed covenants running with the land in the property chain-of-title which restrict the use of the property. These existing institutional controls require the consent of the EPA and MDNR before being modified. Other institutional control measures currently apply or are anticipated to apply by the end of 2006 through closure documentation filings with various agencies identifying the usage of the property and restricting future uses. No additional proprietary use institutional controls would be implemented to control land use, access, or potential future exposures.

The NCP and the Presumptive Remedy approach include an expectation that engineering controls, such as containment, will be used for waste that poses a relatively low long-term threat or where treatment is impracticable. The No Action alternative is inconsistent with the NCP and the Presumptive Remedy approach because the No Action alternative does not include engineering controls, such as containment. The No Action alternative serves as a

baseline for comparison to other alternatives, and is therefore included in the detailed analysis of alternatives, as required by the NCP and Presumptive Remedy guidance.

5.2 Alternative 2 – MDNR-Prescribed Cover with Long-Term Monitoring and Institutional Controls

The Inactive Landfill has an existing cover, but that cover does not meet current ARARs. Accordingly, enhancement of the existing cover is included in Alternative 2 in order to prevent direct contact with landfilled materials. An upgraded landfill cap has the added benefit of reducing the potential for future leaching of contaminants to groundwater, and serves to provide source control.

Under Alternative 2, the Inactive Landfill cap would be upgraded pursuant to MDNR-prescribed requirements, to include 2 feet of engineered materials meeting the MDNR permeability ARAR in areas which currently have less than 2 feet of material, and a 1-foot topsoil layer would then be added across the entire Inactive Landfill cap to meet MDNR ARARs. Figure 5-1 illustrates the Alternative 2 cover design. The upgraded cover would then be vegetated per the ARARs.

Based on information collected as part of the West Lake Landfill OU-2 remedial investigation, approximately 17.5 acres of the Inactive Landfill cap area exhibit a clay thickness less than 24 inches, and none of the Inactive Landfill appears to include a 12-inch topsoil layer per the ARARs (Figure 5-2). Under Alternative 2, the Inactive Landfill cap would be upgraded to include additional soil to meet the Subtitle D-prescribed thickness requirement.

Alternative 2 offer the advantages of meeting the primary Presumptive Remedy RAOs related to containment; specifically preventing direct contact with landfill contents and minimizing infiltration and resulting contaminant leaching to ground water. In addition, through proper placement of the soil cover, surface water runoff and erosion control could be enhanced.

As noted in the "General Response Actions" Section above, the following land use restrictions will be implemented within the boundary of the cover system to ensure that future uses do not impact the effectiveness or integrity of the remedial action:

1. Prevent development and use for residential housing, schools, childcare facilities or playgrounds.

2. Prevent development and use for industrial or commercial purposes, such as manufacturing, offices, storage units, parking lots or other facilities, that are incompatible with the function or maintenance of the landfill cover.

3. Prevent construction activities involving drilling, boring, digging, or other use of heavy equipment that could disturb vegetation, disrupt grading or drainage patterns, cause erosion or otherwise compromise the integrity of the landfill cover, or manage these activities such that any damage to the cover is avoided or repaired.

4. Prevent the use of all groundwater underlying these areas.

5. Retain access necessary for continued maintenance, monitoring, inspections and repair.

At the West Lake Landfill Site, the affected properties are privately owned and the use restrictions must be maintained for a long period of time. Therefore, proprietary controls should be considered because they generally run with the land and are enforceable. The primary examples of proprietary controls, covenants and easements, are based in real property law and generally create legal property interests. These types of controls can be binding on subsequent purchasers of property giving them a measure of long-term reliability.

Based on the above considerations, proprietary controls consisting of deed restrictions, environmental covenants, and other land use restrictions that "run with the land" are preferred institutional control mechanisms for the West Lake Landfill Site to supplement the Well Construction Code and Uncontrolled Sites Registry use prohibitions.

Existing proprietary controls in place for OU-2 of the West Lake Landfill Site consist of deed covenants implemented and recorded in June of 1997 in the chain of title for the entire landfill. This covenant runs with the land and against current and future property owners, and prohibits residential use and groundwater use of the entirety of the West Lake Landfill site. This covenant automatically renews fifty years from the date first recorded and every twenty five years thereafter. The covenant grants EPA, the MDNR, and the property owners the right to enforce the use restrictions, and these restrictions cannot be terminated without the written approval of the current owners, MDNR and EPA.

These deed covenant institutional controls will remain operative for any remedial alternative selected for the Site. Implementation of these institutional controls require ongoing monitoring, maintenance and enforcement to be effective.

Under Alternative 2, the existing OU-2 institutional controls would be maintained and additional institutional controls would be added to insure that the remedy remains protective of human health and the environment. Consistent with OU-1 at the West Lake Landfill, supplemental institutional controls will ensure that any and all future development of the landfill does not lessen the effectiveness of integrity of the landfill cover, runon and runoff control structures, or landfill gas collection and treatment systems, if any. For example, a deed restriction will be inserted into the OU-2 chain-of-title requiring repair of any excavations such that the integrity of the cover or other remedial components is maintained. Because of the potential for methane gas accumulation in any structures that may be built on or near the Inactive Landfill, an additional deed restriction will require testing and foundation venting and/or vapor barrier systems for any new construction.

The institutional control component (Appendix E) of the MDNR CALM draft regulations consists primarily of a restrictive covenant with an easement provision that allows MDNR access to a site for the duration of the restrictive covenant for the purpose of conducting periodic inspections. The CALM Appendix E language provides a useful format for implementing use restrictions at the West Lake Landfill site.

The use restrictions for adjacent disposal areas, including OU-1 Areas 1 and 2, the Buffer Zone and the Crossroads Property are identified under the West Lake Landfill OU-1 Feasibility Study. Coordination across operable units will ensure that use restrictions are complementary.

The exact nature of additional institutional controls that must be implemented will be developed as part of the remedial design activities for the Site.

Alternative 2 includes a provision for landfill gas and groundwater monitoring. The requirements for long-term monitoring are anticipated to be detailed in the OU-2 Record of Decision (ROD). Environmental monitoring would be provided by a groundwater monitoring system, a perimeter landfill gas monitoring system, and a runoff monitoring system. Consistent with the ARARs discussion presented in Section 2, groundwater monitoring for the Inactive Landfill would be designed to verify future improvements in groundwater quality near the southwestern corner of the Inactive Landfill, where prior monitoring indicates localized impacts of VOCs and petroleum hydrocarbons. Figure 5-3 presents an assumed Inactive Landfill groundwater monitoring system, combined with the current detection monitoring system for the Former Active Sanitary Landfill, the proposed monitoring system for West Lake OU-1, and the groundwater monitoring system in place for the LUST site at the asphalt plant. Note that these groundwater monitoring systems provide site-wide coverage. Six existing monitoring wells are proposed for inclusion in the Inactive Landfill monitoring network. The six proposed monitoring wells are screened in the shallow groundwater, within or near the localized area of impact. The six monitoring wells would be sampled on a semi-annual basis for VOCs and petroleum hydrocarbons (gasoline fraction and diesel fraction), because these are the compounds of concern in the area.

Perimeter landfill gas monitoring would be provided by dedicated gas monitoring probes to be installed as part of the remedial action. Thirteen perimeter landfill gas monitoring probes, spaced approximately 500 feet from one another, are proposed as part of the remedial action (Figure 5-4). The perimeter landfill gas monitoring probes would be sampled on a quarterly basis, consistent with typical monitoring frequency for closed solid waste landfills in Missouri. The perimeter landfill gas monitoring data would be used to assess the need or lack of need for passive or active vents within the Inactive Landfill, pursuant to State of Missouri perimeter landfill gas monitoring regulations. A contingent corrective action plan would be developed for landfill gas, in the event that long-term monitoring indicates ARAR exceedances for landfill gas concentrations that are not reduced within a reasonable time period.

Stormwater outfall 003 apparently collects runoff from the Inactive Landfill. Storm water that falls on the western side of the Inactive Landfill appears to move west toward Old St. Charles Rock Road, then south and southeast toward outfall 003. Similarly, site topography suggests that storm water falling on the eastern side of the Inactive Landfill eventually moves toward outfall 003. This represents storm water exiting the site from the Inactive Landfill area. The storm water flow directions will be verified after placement of the additional cover materials, and if additional outfall points are needed to provide data for storm water flow from the Inactive Landfill, the additional points will be added to the program and sampled at the same frequency and for the same parameters as the existing storm water points.

6.0 DETAILED ANALYSIS OF ALTERNATIVES

As described in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988), the detailed analysis of alternatives consists of the analysis and presentation of relevant information needed to allow the selection of a site remedy. During the detailed analysis, each alternative is assessed against evaluation criteria. The results of this assessment are arrayed to compare the alternatives and identify the key tradeoffs among them. As described in Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA, 1991), each alternative is assessed against nine evaluation criteria. During the detailed analysis of alternatives, these criteria are considered individually and equally weighted for importance. The evaluation criteria are divided into three groups based on the function of the criteria during remedy selection. The three groups include the threshold criteria, the balancing criteria, and the modifying criteria.

The threshold criteria relate to statutory requirements that each alternative must satisfy in order to be eligible for selection. These are:

- *Overall protection of human health and the environment.* The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

  When evaluating alternatives in terms of overall protection of human health and the environment, consideration should be given to the manner in which site risks identified in the conceptual site model are eliminated, reduced, or controlled through treatment, engineering controls (for example, containment), or institutional controls.

- Compliance with applicable or relevant and appropriate requirements (ARARs), unless a waiver is obtained. Under this criterion, an alternative is assessed in terms of its compliance with ARARs, or if a waiver is required, how it is justified.

Applicable requirements are federal or state requirements that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are federal or state laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Another factor in determining which requirements must be complied with is whether the requirement is substantive or administrative. Onsite CERCLA response actions must comply with substantive requirements of other environmental laws but not with administrative requirements. Substantive requirements include cleanup standards or levels of control. In general, administrative requirements prescribe methods and procedures such as fees, permitting, inspection, and reporting requirements.

In addition to the legally binding requirements established as ARARs, many federal and state programs have developed criteria, advisories, guidelines, or proposed standards to be considered (TBC). This TBC material may provide useful information or recommend procedures if: (1) no ARAR addresses a particular situation, or (2) existing ARARs do not provide protection. In such situations, TBC criteria or guidelines should be used to set remedial action levels.

The balancing criteria are the technical criteria that are considered during the detailed analysis. The technologies identified as being most practicable for remediation of CERCLA municipal landfill sites have, therefore, been evaluated in light of the following feasibility study balancing criteria:

- Long-term effectiveness and permanence – Under this criterion, an alternative is assessed in terms of its long-term effectiveness in maintaining protection of human health and the environment after response objectives have been met. The magnitude of residual risk and adequacy and reliability of controls are taken into consideration.

  Some aspects of long-term effectiveness include the ability of a cap to maintain its integrity. Long-term effectiveness also includes an evaluation of the magnitude of residual risk. Because the technologies generally considered practicable for municipal landfill sites will not completely eliminate the hazardous substances at a landfill, long-term management of waste is a critical issue.

- Reduction of toxicity, mobility, or volume (TMV) through treatment – Under this criterion, an alternative is assessed in terms of the anticipated performance of the specific treatment technologies it employs. Factors such as the volume of materials destroyed or treated, the degree of expected reductions, the degree to which treatment is irreversible, and the type and quantity of remaining residuals are taken into consideration.

  Generally, reduction of TMV at municipal landfill sites occurs through treatment of hot spots. However, TMV can also be reduced through treatment of groundwater, leachate, or landfill gas. Technologies such as capping and fencing that provide no treatment do not require evaluation under this criterion.

- Short-term effectiveness – Under this criterion, an alternative is assessed in terms of its effectiveness in protecting human health and the environment during the construction and implementation of a remedy before response objectives have been met. The time until the response objectives have been met is also factored into this criterion.

  A significant issue of short-term effectiveness is the effect on the community of truck traffic as large quantities of cap material are hauled onto a site. Both noise and potential increases in vehicular accidents must be considered. To evaluate this criterion, the time required to achieve the response action objectives must be determined.

- Implementability – Under this criterion, an alternative is assessed in terms of its technical and administrative feasibility and the availability of required goods and services. Also considered is the reliability of the technology, the ability to monitor the effectiveness of the remedy, and the ease of undertaking additional response actions, if necessary.

  Administrative implementability is the relative difficulty of coordinating and obtaining approvals from other agencies to perform certain activities. The technical

implementability of a technology, including the ability to construct and/or operate the technology, and the reliability of the technology, largely depends on the treatability of the contaminated material. The availability of goods and services will vary from site to site and will depend primarily on a site's location and accessibility. As an example, the implementability of brining in truckloads of fill material will depend on the source of the material and accessibility to the site.

- Cost – Under this criterion, an alternative is assessed in terms of its present worth in capital and operation and maintenance (O&M) costs.

  For purposes of this FS, estimated costs are presented within +50/-30 percent accuracy. Capital and O&M costs were prepared using March 2006 dollars. In preparing the capital and O&M cost estimates, a contingency allowance of 25 percent was included. With respect to the present worth analyses, a discount rate of 7 percent was assumed, along with a 30 year period of performance.

The modifying criteria are formally assessed after the public comment period. However, state or community views are considered during the FS to the extent they are known. The modifying criteria are as follows:

- State/support agency acceptance

  Under this criterion, an alternative is evaluated in terms of the technical and administrative issues and concerns the state (or support agency) may have. This is a criterion that is addressed in the record of decision (ROD) once formal comments are received on the FS report.

- Community acceptance

  Under this criterion, an alternative is evaluated in terms of the issues and concerns the public may have. As with state acceptance, this is a criterion that is addressed in the ROD once the comments have been formally received on the FS report.

6.1 Alternative 1 - No Action Alternative

This section presents the detailed analysis of the No Action alternative. Under the No Action alternative, no engineering measures will be implemented.

6.1.1 Overall Protection of Human Health and the Environment

The Baseline Risk Assessment performed as part of the West Lake Landfill OU-2 RI/FS indicates that there are no current or anticipated future drinking water uses of the groundwater near the landfill. A localized portion of the alluvial groundwater near the southwestern corner of the Inactive Landfill exhibited concentrations that exceed MCLs, and therefore warrant consideration of a remedial action under the Presumptive Remedy approach. The No Action alternative would not provide overall protection of human health and the environment, because it would not take actions to address the MCL exceedances.

6.1.2 Compliance with ARARs

The No Action alternative is not expected to meet the federal and State ARARs that have been identified. Because the No Action alternative would not include engineering measures associated with source control (e.g., capping), this alternative would not meet the intent of the Presumptive Remedy approach.

6.1.3 Long-Term Effectiveness and Permanence

The No Action alternative would not address current and/or potential future risks. The No Action alternative does not include any additional engineered measures to increase the level of containment anticipated to be achieved as part of the Presumptive Remedy approach, and therefore does not offer the same long-term effectiveness and permanence as does an alternative that includes source control.

6.1.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

The No Action alternative does not include reduction in toxicity, mobility, and volume through treatment.

6.1.5 Short-Term Effectiveness

The No Action alternative does not include construction or implementation; accordingly, the No Action alternative poses no increased risks to workers or the public in the short-term and the short-term effectiveness is high. However, the No Action alternative would not meet RAOs.

6.1.6 Implementability

The No Action alternative is highly implementable.

6.1.7 Costs

Costs have been developed for each of the alternatives, and include capital (construction and nonconstruction/overhead) costs and O&M costs such as cap maintenance, environmental monitoring, etc. A present worth analysis has been performed for each alternative, to provide an equivalent costing basis for evaluating the relative costs of each alternative. Consistent with EPA guidance, the cost estimates for each alternative are order-of-magnitude estimates and are generally within the range specified in the RI/FS guidance of +50% to -30%. The accuracy of the estimates is subject to substantial variation because details of the specific design will not be known until a remedy is implemented. Also, remedial design efforts might reveal possible cost savings as a result of value engineering studies and reduce the cost of implementing the remedy.

Cost estimates are provided in 2006 dollars and include a 25% costing and scoping contingency. For capital cost items, percentage costs for contractor markup, mobilization/demobilization, and insurance (10%); engineering, permitting, and construction management (20%); and regulatory oversight (2.5%) are added to the estimated construction cost subtotal. Present worth cost estimates assume a 7% discount rate in accordance with the most recent EPA guidance (EPA, 2000).

The only costs anticipated to be associated with the No Action alternative are costs for performing Five Year Reviews. The estimated present worth costs for performance of Five Year Reviews over a 30-year period is $47,000.

Appendix C details the O&M activities that are assumed.

6.2 Alternative 2 – MDNR-Prescribed Cover with Long-Term Monitoring and Institutional Controls

Under Alternative 2, the Inactive Landfill cap would be upgraded pursuant to MDNR-prescribed requirements, to include 2 feet of engineered materials meeting the MDNR permeability ARAR in areas which currently have less than 2 feet of material, and a 1-foot topsoil layer would then be added across the entire Inactive Landfill cap to meet MDNR ARARs (see Figure 5-1). The upgraded cover would then be vegetated per the ARARs.

Environmental monitoring would be provided by a groundwater monitoring system, a perimeter landfill gas monitoring system, and a runoff monitoring system as described in Section 5.

6.2.1 Overall Protection of Human Health and the Environment

Through inclusion of an upgraded landfill cap sufficient to meet State of Missouri solid waste landfill closure requirements, Alternative 2 would be protective of human health and the environment. The upgraded landfill cover would prevent contact with landfill contents, minimize infiltration and resulting contaminant leaching to groundwater, and would control the generation of landfill gas by reducing infiltration. In addition, through engineering design to ensure proper slopes are maintained, the upgraded cover would control surface water runoff and erosion.

6.2.2 Compliance with ARARs

The State of Missouri solid waste landfill prescribed cover under Alternative 2 would meet both federal solid waste ARARs associated with a closed landfill and Missouri solid waste ARARs.

6.2.3 Long-Term Effectiveness and Permanence

The State of Missouri solid waste landfill prescribed cover under Alternative 2 would provide long-term effectiveness and permanence through an increased thickness of soil cover, and through meeting other ARARs such as sloping requirements and erosion controls.

6.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

There would be no reduction of toxicity, mobility, or volume through treatment under Alternative 2, other than an indirect reduction of mobility of contaminants sourced from the landfill materials to leach into groundwater. No treatment residuals would be generated from this alternative.

6.2.5 Short-Term Effectiveness

The short-term impact to the community and workers would be minimal under the State of Missouri solid waste landfill prescribed capping alternative (Alternative 2). Placement of low permeability soil and topsoil is a routine closure activity associated with solid waste landfills. Local roads are sufficient to allow truck traffic needed to haul the low permeability soil and topsoil, and heavy equipment can operate on the Inactive Landfill with minimal disturbance to the community.

6.2.6 Implementability

Placement of low permeability soil and topsoil is a routine closure activity associated with solid waste landfills. There are no unknown or non-routine technical difficulties associated with Alternative 2. A soil cover is very reliable; accordingly, there should be minimal technical problems that could result in schedule delays. Administratively, construction of a State of Missouri solid waste landfill prescribed cover would involve coordination with other offices and agencies that are routinely utilized when placing final cover on solid waste landfills. Necessary equipment is readily available, and the facility has the technical capabilities within the company and through its network of vendors and consultants to readily implement placement of a State of Missouri solid waste landfill prescribed cover.

6.2.7 Costs

Estimated capital, annual O&M, and 30-year present worth costs for Alternative 2 are as follows.

- Estimated capital costs: $6,669,837
- Estimated annual O&M costs: $45,832
- Estimated 30-year present worth costs: $7,214,521

7.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents the comparative analysis of alternatives in which the relative performance of each alternative is evaluated relative to each of the evaluation criteria. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another.

Overall protection of human health and the environment and compliance with ARARs serve as the threshold determinations in that they must be met by any alternative in order for it to be eligible for selection.

7.1 Overall Protection of Human Health and the Environment

This evaluation criterion provides a check to assess whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

The No Action alternative would not provide an increase in protection of human health and the environment through source control or environmental monitoring. Alternative 2, placement of a State of Missouri-prescribed cover with environmental monitoring and institutional controls, would provide an increase in protection of human health and the environment through source control and the aforementioned environmental monitoring.

Figure 7-1 illustrates the projected topography of Alternative 2 upon placement of the additional clay needed to achieve 24-inches.

7.2 Compliance with ARARs

This evaluation criterion is used to determine whether each alternative will meet all of its federal and State ARARs. The following are addressed:

- Compliance with chemical-specific, location-specific, and action-specific ARARS - This factor addresses whether the ARARs can be met, and if not, whether a waiver is appropriate.

The No Action alternative (Alternative 1) would not comply with ARARs. Alternative 2 would comply with both federal ARARs and State of Missouri ARARs.

Alternative 2 would rely on the upgraded cover to reduce the potential for infiltration through the Inactive Landfill.

7.3 Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion addresses the results of a remedial action in terms of the risk remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The following components of the criterion are addressed for each alternative:

- Magnitude of residual risk – This factor assesses the residual risk remaining from untreated waste or treatment residuals at the conclusion of remedial activities (e.g., after source containment is complete).

- Adequacy and reliability of controls – This factor assesses the adequacy and suitability of controls, if any, that are used to manage treatment residuals or untreated wastes that remain at the site.

Neither of the alternatives would generate treatment residuals. Accordingly, both are considered to provide long-term effectiveness and permanence with respect to treatment residuals. The degree of long-term effectiveness and permanence provided by each alternative is primarily differentiated by the ability of the alternative to reduce potential infiltration into the Inactive Landfill and the ability of the alternative to provide permanence with respect to the final cover.

Alternative 1 (No Action) would provide some a measure of long-term effectiveness and permanence, given that the Inactive Landfill currently has a low-permeability cover that meets or exceeds ARARs over a majority of the Inactive Landfill area.

Alternative 2 would include upgrades to the Inactive Landfill cover to meet federal and State of Missouri ARARs (Alternative 3), thereby providing an increased measure of long-term effectiveness and permanence compared to the No Action Alternative.

7.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Because the Inactive Landfill has no identified hot spots, neither of the alternatives includes a treatment component. Accordingly, this criterion does not apply.

7.5 Short-Term Effectiveness

Short-term effectiveness addresses the effects of each alternative during the construction and implementation phase. Under this criterion, alternatives are evaluated with respect to their effects on human health and the environment during implementation of the remedial action. The following factors are addressed as appropriate for each alternative:

Protection of the community during remedial actions – This aspect of short-term effectiveness addresses any risk that results from implementation of the proposed remedial action, such as dust from excavation, transportation, etc.

Protection of workers during remedial actions – This factor assesses threats that may be posed to workers and the effectiveness and reliability of protective measures that would be taken.

Environmental impacts – This factor addresses the potential adverse environmental impacts that may result from the construction and implementation of an alternative and evaluates the reliability of the available mitigation measures in preventing or reducing the potential impacts.

Time until remedial response objectives are achieved – This factor includes an estimate of the time required to achieve protection for either the entire site or individual elements associated with specific site areas.

Alternative 1 would involve no short-term risks to the community, workers, or the environment.

Alternative 2 would result in some risk to the community associated with transportation of the materials to the site, and some risk associated with dust generation. There would be some risk to workers, but because Alternative 2 relies on proven technology routinely applied to solid waste landfills, the risks are minimal. There would be some risk to the environment, but the risks could be easily mitigated through the use of silt fencing commonly used for construction projects.

7.6 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during its implementation. This criterion involves analysis of the following factors:

Technical Feasibility

- Construction and operation – This relates to the technical difficulties and unknown risks associated with a technology.
- Reliability of technology – This focuses on the likelihood that technical problems associated with implementation will lead to schedule delays.
- Ease of undertaking additional remedial action – This includes a discussion of what, if any, future remedial actions may need to be undertaken and how difficult it would be to implement such additional actions.
- Monitoring considerations – This addresses the ability to monitor the effectiveness of the remedy and includes an evaluation of the risks of exposure should monitoring be insufficient to detect a system failure.

Administrative Feasibility

- Activities needed to coordinate with other offices and agencies.

Availability of Services and Materials

- Availability of adequate offsite treatment, storage capacity, and disposal services.
- Availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources.
- Availability of services and materials, plus the potential for obtaining competitive bids.

Each of the proposed alternatives is considered implementable. Alternative 1 (No Action) would involve no technical or administrative feasibility issues. Alternative 2 would rely on proven, reliable technologies that are routinely applied to solid waste landfills, including capping upgrades, institutional controls, groundwater monitoring, landfill gas monitoring, runoff monitoring, etc. In particular, the Respondents own the OU-2 properties, and so can add all needed proprietary use deed restrictions to the property chain-of-title. Services and materials associated with Alternative 2 are readily available.

7.7 Cost

Costs have been developed for each of the alternatives, and include capital (construction and nonconstruction/overhead) costs and O&M costs such as cap maintenance, environmental monitoring, etc. A present worth analysis has been performed for each alternative, to provide an equivalent costing basis for evaluating the relative costs of each alternative. Consistent with EPA guidance, the cost estimates for each alternative are order-of-magnitude estimates and are generally within the range specified in the RI/FS guidance of +50% to -30%. The accuracy of the estimates is subject to substantial variation because details of the specific design will not be known until a remedy is implemented. Also, remedial design efforts might reveal possible cost savings as a result of value engineering studies and reduce the cost of implementing the remedy.

Cost estimates are provided in March 2006 dollars and include a 25% costing and scoping contingency. For capital cost items, percentage costs for contractor markup, mobilization/demobilization, and insurance (10%); engineering, permitting, and construction management (20%); and regulatory oversight (2.5%) are added to the estimated construction cost subtotal. Present worth cost estimates assume a 7% discount rate in accordance with the most recent EPA guidance (USEPA, 2000).

Capital Costs

The estimated capital costs for Alternative 1 are $0. The estimated capital costs for Alternative 2 (State of Missouri Prescribed Cover) are $7,214,521. The capital costs for Alternative 2 include the cost of the cover upgrades, plus drilling and installation of perimeter landfill gas monitoring probes as discussed in earlier Sections of this FS Report.

O&M Costs

The estimated O&M costs for Alternative 1 are $4,000 to $5,000 per year. The estimated O&M costs for Alternative 2 (State of Missouri Prescribed Cover) are $45,832 per year. The O&M costs for Alternative 2 include the cost of the cover maintenance, groundwater monitoring and analysis, perimeter landfill gas monitoring, runoff monitoring, etc. Appendix C details the O&M activities that are assumed.

Present Net Worth Costs

The Present Net Worth costs for Alternative 1 are $46,721. The Present Net Worth costs for Alternative 2 (State of Missouri Prescribed Cover) are $7,214,521.

7.8 State (Support Agency) Acceptance

This assessment evaluates the technical and administrative concerns the state may have regarding the alternatives. This criterion will be addressed in the ROD once comments on the FS report and proposed plan have been received.

7.9 Community Acceptance

This assessment evaluates that issues and concerns the public may have regarding each of the alternatives. As with state acceptance, this criterion will be addressed in the ROD once comments on the FS report and proposed plan have been received.

7.10 Consistency with Operable Unit 1

A key issue as relates to the selected alternative for OU-2 will be the integration of the final cover contours for the Inactive Landfill under OU-2 with the final cover contours for OU-1, Area 2. Several cover alternatives, each with their own final contours, have been evaluated for OU-1, Area 2. Until a final decision is made with regard to the selected alternative for OU-1 Area 2, and the Inactive Landfill portion of OU-2, final integration of contours is premature. However, examples can be provided using existing data. Figure 7-2 illustrates the final clay cover contours for the Inactive Landfill under Alternative 2 (Missouri Prescribed Cover) compared to the Alternative L4 – Fill contours for OU-1, Area 2. Because OU-1, Area 2 Fill contours were designed with information regarding existing Inactive Landfill topography, and because Alternative 2 does not significantly alter the existing topography of the Inactive Landfill, the proposed contours for each of the Operable Units appear to coordinate fairly well. The proposed final contours for other OU-1, Area 2 alternatives are expected to coordinate similarly well with the proposed final contours for the Inactive Landfill. During the final design phase, after the selection of alternatives for both operable units, a supplemental evaluation will be made to ensure that the final contours for the two operable units coordinate with each other.

8.0 REFERENCES

Auxier & Associates, Inc., 1998. Baseline Risk Assessment, West Lake Landfill Operable Unit 1, March.

Boyer, Ivan; Victor Hauser; Dianna Gimon; and Marc Gill, 1999. Decision Tool for Landfill Remediation, August.

Dames & Moore, 1991, Phase III Radiological Site Assessment, Earth City Industrial Park.

Engineering Management Support, Inc., 2000. Remedial Investigation Report, West Lake Landfill, Operable Unit 1, April.

Engineering Management Support, Inc., 2006. Feasibility Study Report, West Lake Landfill, Operable Unit 1, May.

EPA, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/6-08/004, OSWER Directive 9355.3-01, October.

EPA, 1990, National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300, Federal Register 55:8666, March 8.

EPA, 1991, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites, EPA/540/P-91/001, February.

EPA, 1993a, Presumptive Remedy for CERCLA Municipal Landfill Sites, EPA 540-F-93-035, OERR Directive No. 9355.0-49FS, September.

EPA, 1993b, Administrative Order on Consent for Remedial Investigation/Feasibility Study, Docket no. VII-93-f-005.

EPA, 2000, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, EPA 540-R-00-002, OSWER 9355.0-75, July.

EPA Region VII, 1994, Administrative Order on Consent (and attached Remedial Investigation/Feasibility Study Statement of Work, West Lake Landfill OU-2, dated December 7, 1994) in the matter of Laidlaw Waste Systems (Bridgeton), Inc. Respondent, Docket No. VII-94-F-0025, March 19.

EPA Region VII, 1996, Second Amendment to Administrative Order on Consent, West Lake Landfill OU-2, in the matter of Laidlaw Waste Systems (Bridgeton), Inc. Respondent, Docket No. VII-94-F-0025, December 2.

EPA Region VII, 1997, First Amendment to Administrative Order on Consent (and attached Remedial Investigation/Feasibility Study Statement of Work, West Lake Landfill, revised March 21, 1997) in the matter of Cotter Corporation (N.S.L.), and Laidlaw Waste Systems (Bridgeton), Inc, and Rock Road Industries, Inc., and US Department of Energy, Respondents, Docket No. VII-93-F-005.

Feezor Engineering, Inc., 2005. Construction Documentation Report – Bridgeton Leachate Pond Closure, April.

Golder Associates Inc., 1995. Final Remedial Investigation/Feasibility Study Work Plan, West Lake Landfill Operable Unit 2, Bridgeton, Missouri, April.

Golder Associates Inc., 1996. Physical Characterization Technical Memorandum for the West Lake Landfill Operable Unit 2, Bridgeton, Missouri, August.

Herst & Associates, Inc., 2005, Remedial Investigation Report, West Lake Operable Unit 2, September.

Mclaren-Hart Environmental Engineering Corporation, 1994. RI/FS Work Plan for the West Lake Site, Bridgeton, Missouri

McLaren-Hart Environmental Engineering Corporation, 1996. Overland Gamma Survey Report, West Lake Landfill, Areas 1 and 2, April.

Midwest Environmental Consultants, 1995. Permit Consolidation Engineering Report, Laidlaw Waste Systems (Bridgeton), Inc. Sanitary Landfill, June.

Missouri Department of Natural Resources, 2001, Cleanup Levels for Missouri (CALM) – Introduction and Appendix B, Tier 1 Soil and Groundwater Cleanup Standards, Division of Environmental Quality, Hazardous Waste Program, June 29.

Nuclear Regulatory Commission, 1988, Radioactive Material in the West Lake Landfill, Division of Industrial andMmedical Nuclear Safety, Office of Nuclear Material Safety and Safeguards.

Veritox, Inc., 2005. West Lake Landfill Operable Unit 2 Baseline Risk Assessment, September.

TABLES

Table 2-1: Preliminary Identification of Potential Chemical-Specific ARARs and TBC Criteria

Citation	Media	Requirement	Preliminary Determination	Remarks
Safe Drinking Water Act (SDWA), (42 USC § 300f & 40 CFR § 141)	Water	Protect drinking water quality by limiting the levels of contaminants that can adversely affect public health and which are known or anticipated to occur in public water systems.	Potentially relevant and appropriate	Any remedial action will need to meet MCLs and MCLGs for certain contaminants of concern in groundwater.
Missouri Drinking Water Standards (Missouri MCLs) (10 CSR § 60-4.010)	Water	Protect drinking water quality by limiting the levels of contaminants that can adversely affect public health and which are known or anticipated to occur in public water systems.	Potentially relevant and appropriate	Any remedial action will need to meet Missouri MCLs for certain contaminants of concern in groundwater.
Clean Water Act (CWA) (33 USC § 1311)	Water	The primary purpose of the CWA is to restore and maintain surface water quality by restricting direct discharges, indirect discharges, or dredge-and-fill operations into waters and wetlands.	Potentially applicable	The permitted landfills are discharging in compliance with the CWA permits. Discharges from the Inactive Landfill are either captured by the Former Active Sanitary Landfill's collection and treatment systems, or result in no adverse impact to surface waters.
Missouri Water Quality Standards (10 CSR § 20-7.031)	Water	Establish anti-degradation policies with three levels of protection for Missouri surface water bodies; set general water quality criteria applicable to all waters of the state; and set specific criteria for classified waters of the state.	Potentially applicable	The permitted landfills are discharging in compliance with Missouri Water Quality standards as set by the CWA permits. Discharges from the Inactive Landfill are either captured by the Former Active Sanitary Landfill's collection and treatment systems, or result in no adverse impact to surface waters. Discharges to subsurface acquifers will be addressed by the remedy.

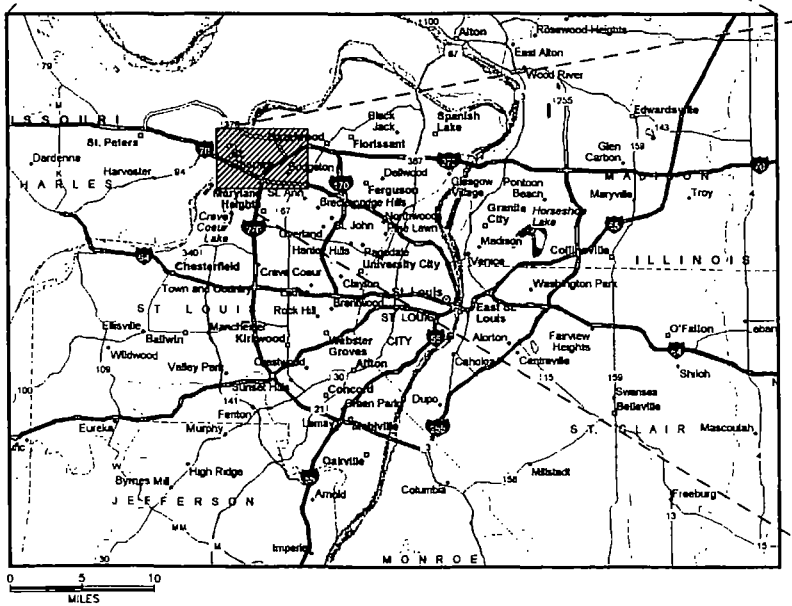
Table 2-2: Preliminary Identification of Potential Location-Specific ARARs and TBC Criteria

Citation	Media	Requirement	Preliminary Determination	Remarks
Archaeological and Historic Preservation Act (16 USC 469)	Land	Data recovery and preservation activities should be conducted if prehistoric, historic and archaeological data might be destroyed as a result of a federal, federally assisted, or federally licensed activity or program.	Potentially applicable	No destruction of such data should result. The site has been disturbed by past human activities and is not expected to contain archaeological data.
Endangered Species Act (16 USC 1531 et seq., 50 CFR 17.402, 40 CFR 6.302(h)	Any	Federal agencies should ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify any critical habitat.	Potentially applicable	No identified critical habitat exists at the site, and no adverse impacts to threatened or endangered species are expected from any remedial action. A biological assessment was part of the Baseline Risk Assessment, which did not identify any federal listed or proposed threatened or endangered species or habitats.
Missouri Wildlife Code, Endangered Species (1989) (RSMO 252.240, 3 CSR 10-4.111)	Any	Endangered species, i.e., those designated by the US Department of the Interior and the Missouri Department of Conservation as threatened or endangered, should not be pursued, taken, possessed or killed.	Potentially applicable	No identified critical habitat exists at the site, and no adverse impacts to threatened or endangered species are expected from any remedial action.
Floodplain Management Executive Order (EO 11988, 40 CFR 6.302(b)	Land	Federal agencies should avoid, to the maximum extent possible, any adverse impacts associated with direct and indirect development of a floodplain.	Potentially applicable	This requirement may be applicable to any remedial action for the Ford property and the North Surface Water Body. Mitigation may minimize adverse impacts.
Clean Water Act (33 USC 1251-1376) Dredged or Fill Material Discharges (Section 404 Program)	Land	Dredge or fill material is not to be discharged into a wetland, as defined by the Army Corps of Engineers, without a permit.	Potentially applicable	This requirement may be applicable to any off-site borrow area if the location contains wetlands or if the borrow activities could impact wetlands. No wetlands have been identified on-site.
Farmland Protection Policy Act (7 USC 4201 et seq.), Farmland Protection (7 CFR 658, 40 CFR 6.302(c))	Land	Applies to prime or unique farmland, or that with state and local importance. Federal agencies should take steps to ensure that federal actions do not cause US farmland to be irreversibly converted to nonagricultural uses in cases in which other national interests do not override the importance of the protection of farmland or otherwise outweigh the benefits of maintaining farmland resources. Criteria developed by the US Soil Conservation Service are used to identify and take into account the adverse effects of federal programs on farmland preservation. Federal agencies should consider alternative actions that could lessen adverse effects and should ensure that programs are compatible with state and local government and private programs and policies to protect farmland.	Potentially applicable	This requirement would be applicable to any potential soil borrow area off-site. Mitigation measures and restoration activities at off-site borrow areas could minimize adverse impacts on farmland.

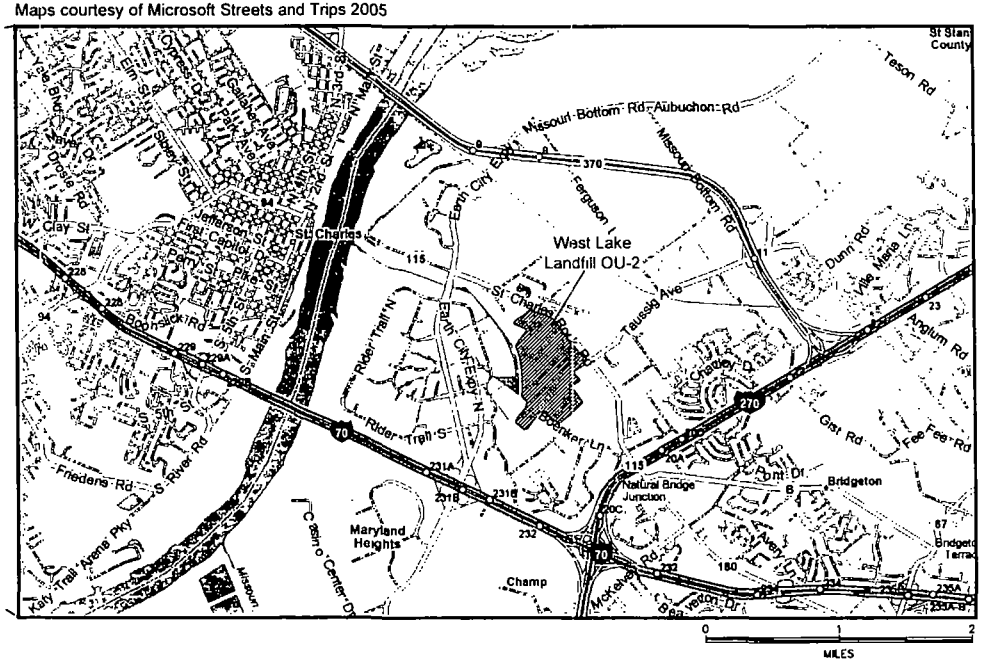
Table 2-3: Preliminary Identification of Potential Action-Specific ARARs and TBC Criteria

Citation	Media	Requirement	Preliminary Determination	Remarks
RCRA Subtitle D	Land	RCRA Subtitle D sets minimum criteria for the operation, closure and post-closure of solid waste landfills.	Not applicable	The landfill units in OU-2 are either currently permitted or were closed prior to RCRA's enactment. Further, Missouri is an approved state for RCRA Subtitle D landfills, therefore Missouri laws and regulations regarding solid waste disposal landfills are the applicable environmental requirement for analysis.
Missouri Solid Waste Statute and Rules for Sanitary Landfills (Mo. Rev. Stat. § 260.200, 10 CSR § 80-3)	Land	Missouri law and regulatory standards govern permitting, operation, closure and post-closure of sanitary landfills. Although not applicable to the Inactive Landfill, these laws are relevant and appropriate and will provide a framework for applying the presumptive capping remedy to the Inactive Landfill.	Potentially relevant and appropriate	The permit terms for the Former Active Sanitary Landfill and the Closed Demolition Landfill must be complied with in any response action. The requirements for landfill closure contents, slope and grading/vegetation maybe relevant and appropriate as a framework for the Inactive Landfill to the extent needed to achieve the statutory goals of erosion control and reduced infiltration of precipitation through the landfill contents.
Construction-related Regulatory Requirements: Missouri Air Quality Regulations (10 CSR §§ 10-6.010 & 6.060, 10-6.170, 10-6.220, 10-5.160, 10-5.490, and 19 CSR § 20-10.040); Missouri Storm Water Discharge and Management Regulations (10 CSR § 20-6.200); and Missouri Groundwater Extraction or Monitoring Well Construction Code (10 CSR § 23-4.010)	Air and Water	Missouri laws and regulatory standards governing construction-related emisions and discharges. These are potentially applicable to installation of the presumptive remedy landfill cap on the Inactive Landfill.	Potentially applicable	Because these laws and regulations arise in the construction context, the site health and safety plan and the construction plans should include consideration of these limitations on emissions and discharges.
Missouri Landfill Post-Closure Care and Corrective Action Plans (10 CSR § 80-2.030)	Land	Missouri law and regulatory standards governing closure and post-closure plans for permitted landfills. Although not applicable to the Inactive Landfill, these regulations are relevant and appropriate and will provide a framework for creating a closure and post-closure plan to be applied after implementation of the presumptive capping remedy at the Inactive Landfill.	Potentially relevant and appropriate	The requirements for landfill closure and post-closure maybe relevant and appropriate as a framework for the Inactive Landfill to the extent needed to achieve the regulatory goals.

FIGURES



Maps courtesy of Microsoft Streets and Trips 2005

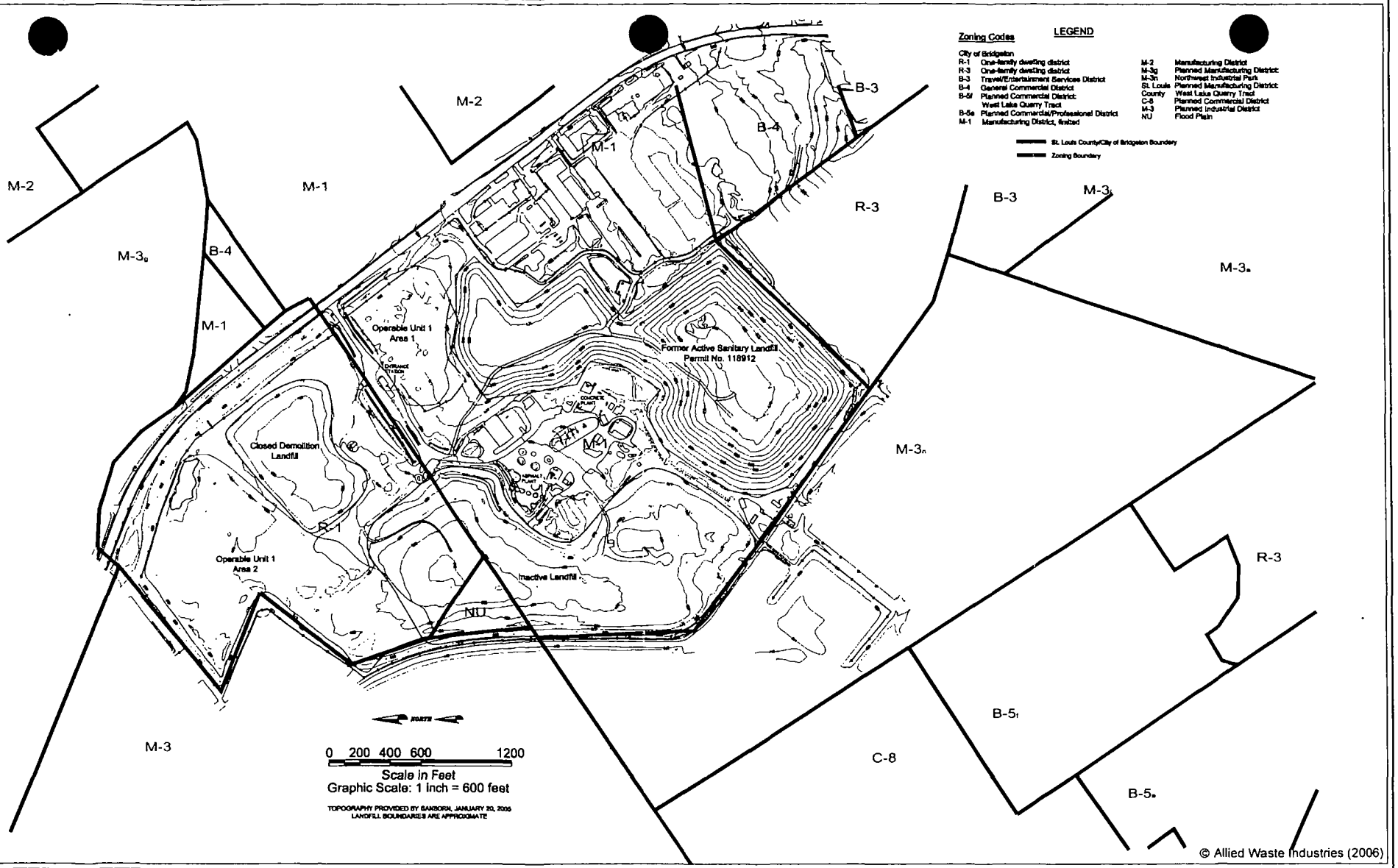


© Allied Waste Industries (2006)

4630 South Highway 94
North Outer Road
St Charles Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.®

West Lake Landfill OU-2
Bridgeton, Missouri

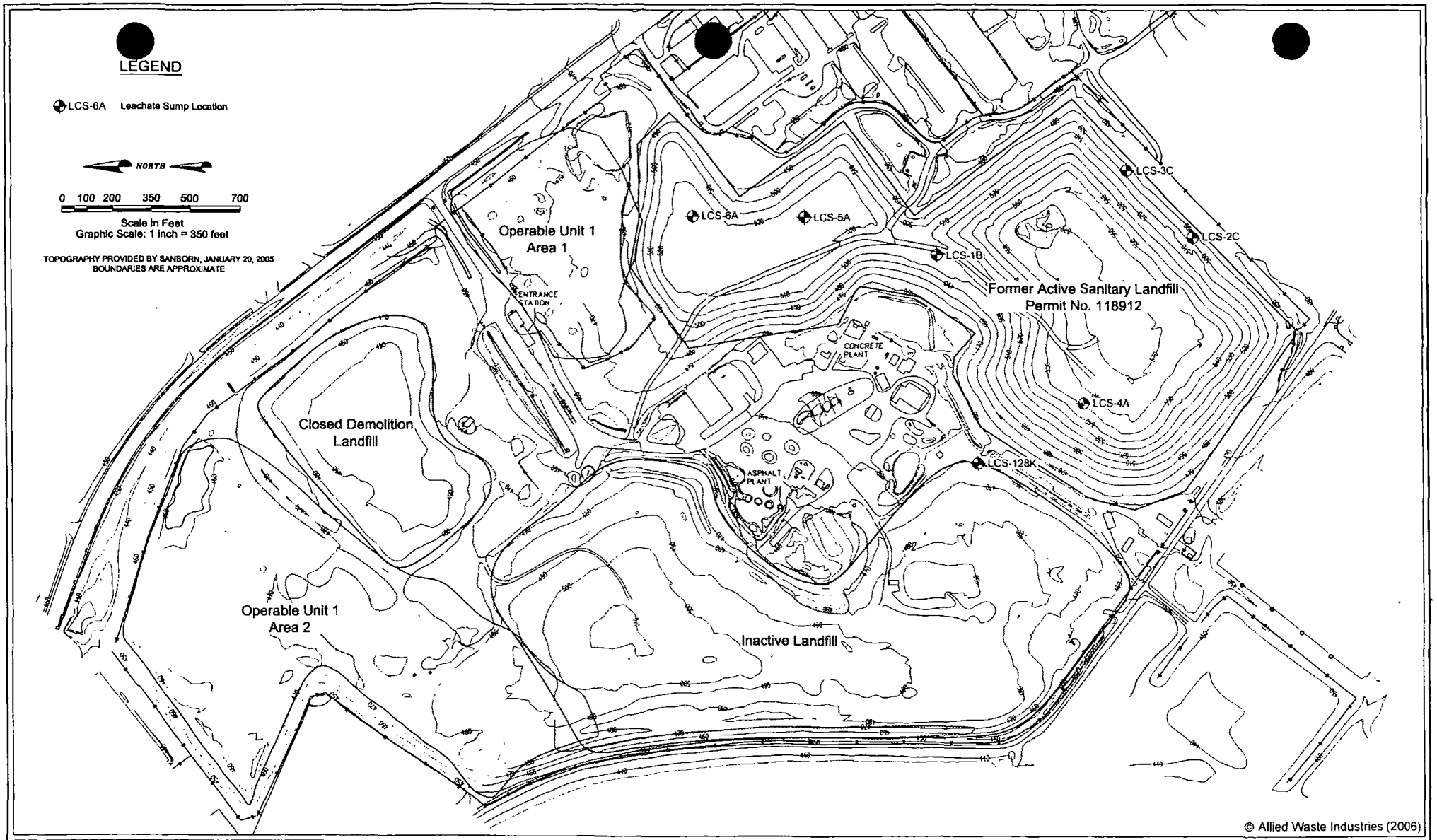
Figure 1-1
Site Location Map



4630 South Highway 94
North Outer Road
St. Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 1-2
Zoning & Land Use Map

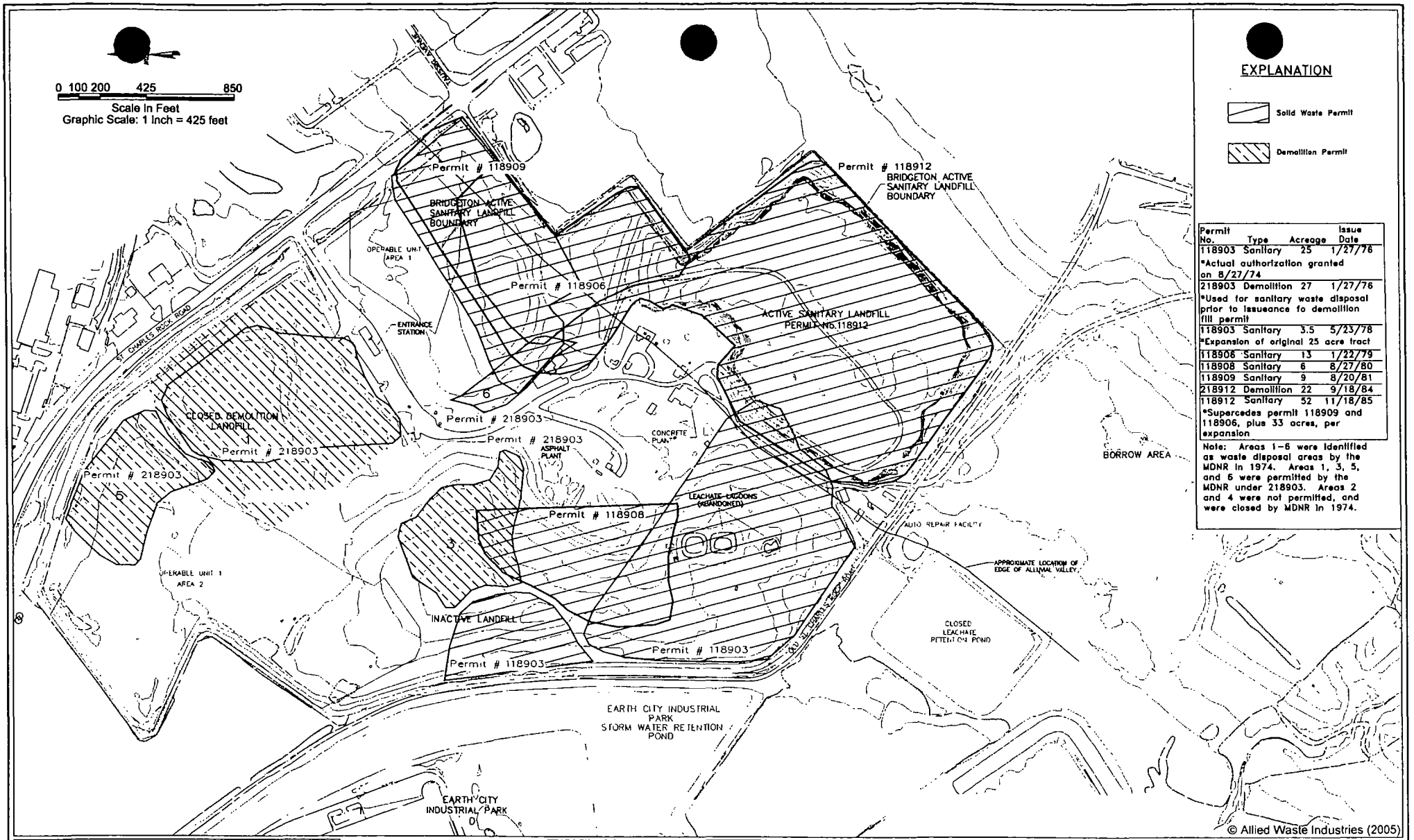


© Allied Waste Industries (2006)

4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.®

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 1-3
Leachate Risers - Former Active Sanitary Landfill



Permit No.	Type	Acreage	Issue Date
118903	Sanitary	25	1/27/76
*Actual authorization granted on 8/27/74			
218903	Demolition	27	1/27/76
*Used for sanitary waste disposal prior to issuance fo demolition fill permit			
118903	Sanitary	3.5	5/23/78
*Expansion of original 25 acre tract			
118906	Sanitary	13	1/22/79
118908	Sanitary	6	8/27/80
118909	Sanitary	9	8/20/81
218912	Demolition	22	9/18/84
118912	Sanitary	52	11/18/85
*Supercedes permit 118909 and 118906, plus 33 acres, per expansion			

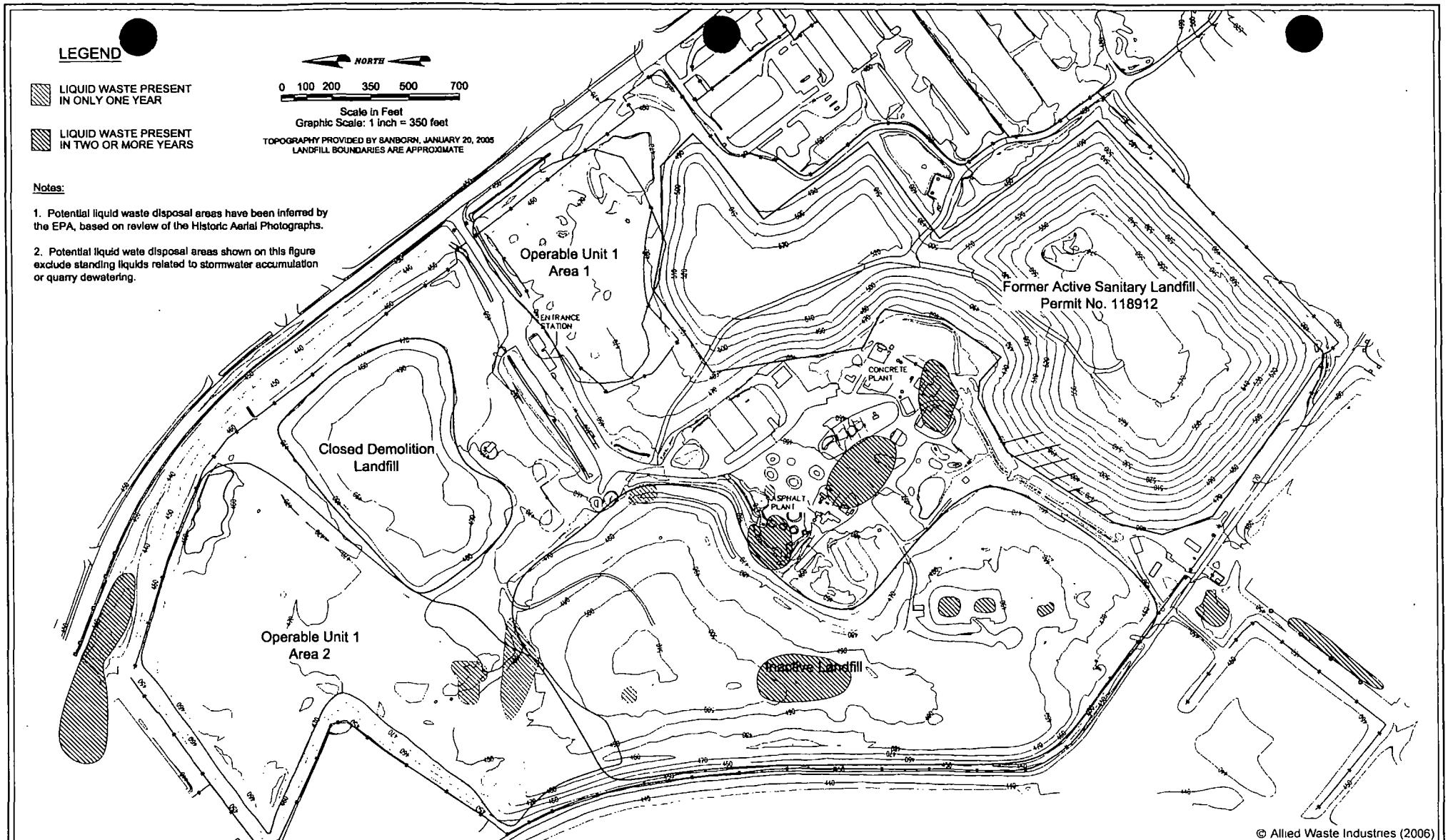
Note: Areas 1–6 were identified as waste disposal areas by the MDNR in 1974. Areas 1, 3, 5, and 6 were permitted by the MDNR under 218903. Areas 2 and 4 were not permitted, and were closed by MDNR in 1974.

© Allied Waste Industries (2005)

4830 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

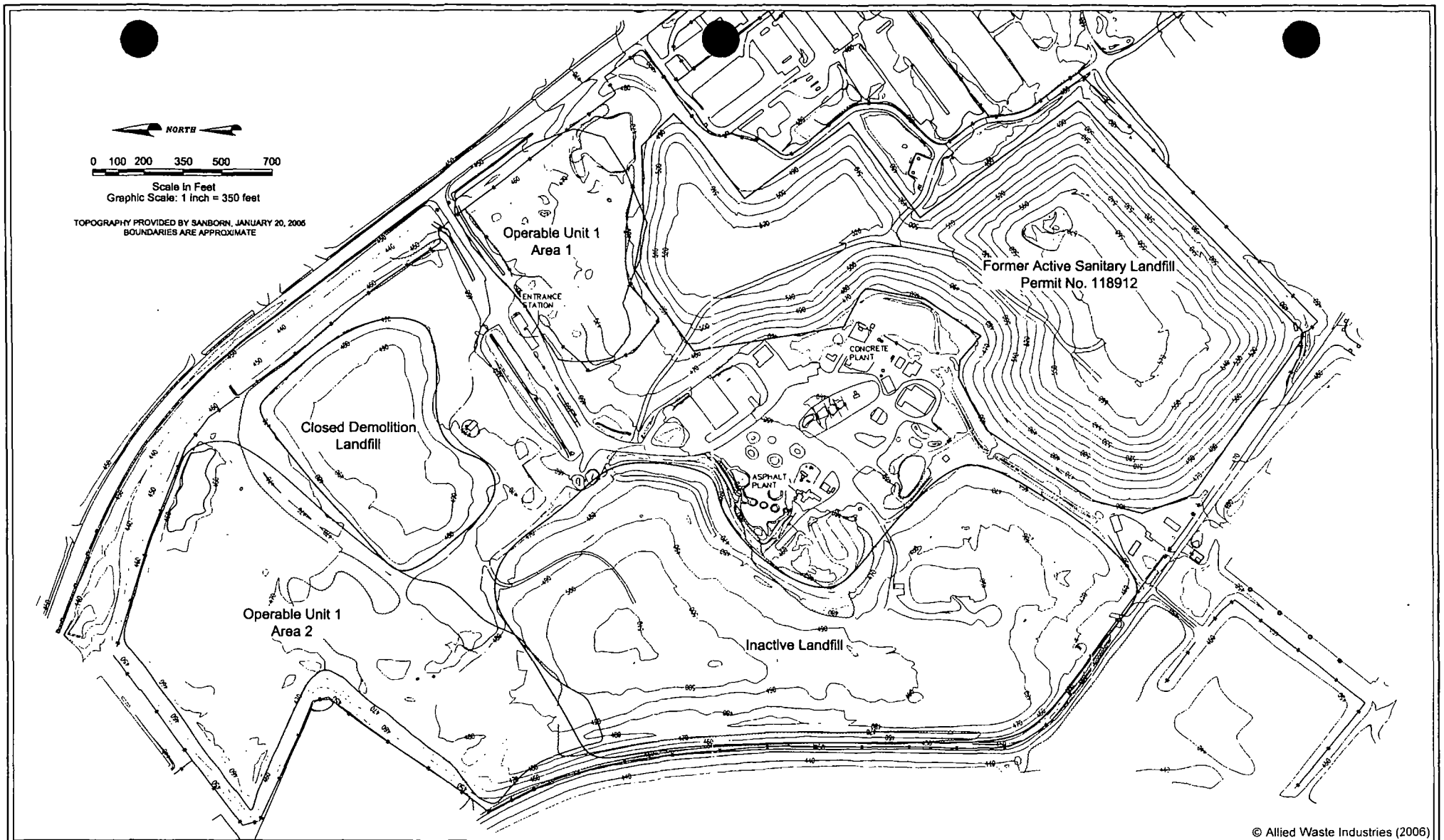
Figure 1-4
Missouri Department of Natural Resources Permitted Areas



4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 1-5
Potential Liquid Disposal Areas Inferred by the EPA

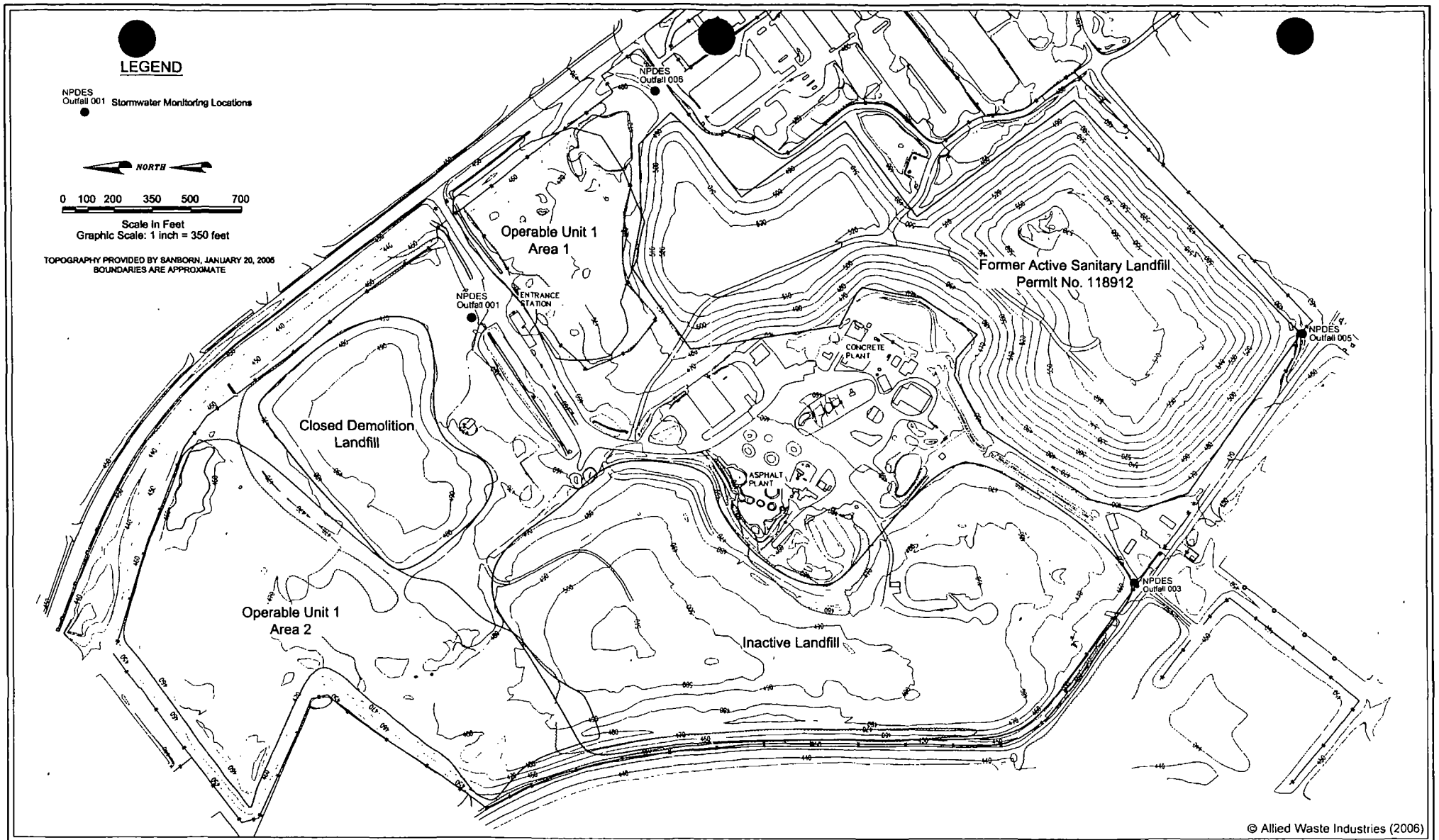


© Allied Waste Industries (2006)

4630 South Highway 94
North Outer Road
St. Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.®

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 1-6
Site-wide Landfill
Area Boundaries



4630 South Highway 94
North Outer Road
St Charles Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 1-7
Stormwater Monitoring Locations

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
No Action	None	None	No action taken.	Required for consideration by the NCP.
Institutional Controls*	Access Restrictions	Fences and guards	Access restrictions can mitigate exposures by limiting access and use.	Already existing or planned.
	Proprietary Controls	Deed restrictions	Proprietary controls restricting land use that are legally enforceable against subsequent owners.	Already Existing. Covenant restrictions have been recorded by each of the owners against their respective parcels prohibiting residential use.
		Deed notices	Non-enforceable informational document filed in public land records alerting anyone searching records to important information about property.	Potentially applicable.
		Easements	Property right conveyed by a landowner to another party which the second party rights with regard to the land of the first party.	Potentially applicable in conjunction with other response actions.
		Covenants	Promise by one landowner to another made in connection with conveyance of property. Promise to refrain from using property in a certain manner.	Potentially applicable in conjunction with other response actions.
		Groundwater use restrictions	Water or well use restrictions such as limitations on the drilling of new wells.	Already Existing. Restrictive covenants recorded by each of the owners against their respective parcels prohibit use of groundwater from beneath the landfill. These deed restrictions cannot be terminated without the written approval of the then owners, the Missouri Department of Natural Resources (MDNR), and the EPA.
		Advisories	Publicly-issued warnings that provide notice to potential users of groundwater of some existing or impending risk associated with its use.	Not applicable as there is no groundwater use at or in the vicinity of site.
Monitoring	Monitoring	Groundwater, surface water, and sediment monitoring	Monitoring to evaluate site conditions over time and/or remedial action performance.	Potentially applicable.

LEGEND

[ ] Technology and/or Process Option Screened out on the basis of technical implementability.

* Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-1
Technical Implementability Screening of Remediation Technologies and Process

West Lake Landfill OU-2 Feasibility Study

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
In-situ Containment	Surface Controls/Diversions	Diversion/collection, grading, graded contours, swales, and berms, and vegetation to isolate storm water from landfilled materials.	Surface controls can limit contaminant mobility and mitigate potential exposures and migration via surface water by attenuating storm water run-on and runoff. These processes can be implemented with conventional equipment.	Potentially applicable.
	Surface Water/Sediment Control Barriers	Sediment traps, sedimentation basins	Surface water/sediment control barriers can limit contaminant mobility and mitigate potential exposures by preventing sediment from storm water run-on and runoff from migrating. These processes can be implemented with conventional equipment.	Potentially applicable.
	Dust Controls	Revegetation, capping	Dust controls can limit contaminant mobility and mitigate potential migration via air and storm water by controlling particulate resuspension. These processes can be implemented with conventional equipment.	Potentially applicable.
	Capping and Covers *	Soil, clay, and vegetation; asphalt or concrete; synthetic membrane material; and multilayer, multimedia material	Capping can limit contaminant mobility and mitigate potential migration via air, surface water, and groundwater by controlling particulate resuspension, storm water run-on and runoff, and precipitation-enhanced percolation and leaching. These processes can be implemented with conventional equipment.	Soil, clay, and vegetation, plus synthetic membrane potentially applicable. Asphalt, concrete, and multimedia materials screened out due to excessive cost.

LEGEND

[ ] Technology and/or Process Option Screened out on the basis of technical implementability.

* Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-1 (con't.)
Technical Implementability Screening of Remediation Technologies and Process

West Lake Landfill OU-2 Feasibility Study

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Physical Treatment/ Pretreatment In-Situ	Dewatering/Drying	Solar evaporation, pumping, and gravity drainage trenches	For sediment, dewatering/drying can limit the mobility and reduce the volume of material and mitigate potential exposure and migration at the affected area. These processes can be implemented with conventional methods.	Eliminated. Not a component of the presumptive remedy and site conditions do not support its use.
	Nonthermal extraction	Vacuum extraction and aqueous soil flushing.	Vacuum extraction can be used to remove landfill gas from soil but may require a point source treatment system such as vapor phase granular activated carbon pior to discharge to the atmosphere. The primary action associated with soil flushing with water is a physical "sweeping" to accelerate contaminant migration by injection wells or spraying/ponding (surface application); thus it is discussed here as a physical technology. Water alone is typically a poor flushing solution and this process is generally ineffective for complex wastes or for treating soil with moderate to high adsorption capacity, low permeability.	Eliminated. Not a component of the presumptive remedy and site conditions do not support its use.
	Thermal Destruction	In-situ vitrification (ISV)	In-situ thermal destruction can reduce the toxicity, mobility, and volume of contaminated soil and mitigate potential exposures and migration by physically altering the contaminant source. For in-situ vitrification, an electric current is passed through electrodes to melt the soil or sediment and upon cooling, a glassy crystalline matrix is formed that incorporates inorganic contaminants. In-situ vitrification has been implemented at a limited number of sites. Obtaining a continuous matrix after the melt with the nature of the subsurface soil at the Inactive Landfill may be difficult.	Eliminated. Not a component of the presumptive remedy and site conditions do not support its use.
Chemical Treatment Pretreatment In-Situ	Soil Flushing	Acid/base, surfactant, chelating agent, and organic solvent solution via surface application and injection/extraction wells	In-situ chemical flushing can reduce the mobility and volume of contaminated soil via desorptive reactions and mitigate potential exposures and migration by altering the contaminant source. This technology can be used as an initial treatment step to leach contaminants from a waste matrix (e.g., via solution mining). This technology is contaminant-specific.	Eliminated. Not a component of the presumptive remedy and site conditions do not support its use.
	Stabilization/solidification	Lime-based and Portland cement-based pozzolanic reactions, asphalt-based thermoplastic microencapsulation, and catalyzed polymerization.	In-situ stabilization/solidification processes are typically used to treat soil contaminated with heavy metals and high molecular weight organic compounds by binding the contaminants in place in an insoluble matrix. Drills, augers, and paddles can be used to introduce chemical reagents.	Eliminated. Not a component of the presumptive remedy and site conditions do not support its use.

LEGEND

[ ] Technology and/or Process Option Screened out on the basis of technical implementability.

★ Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-1 (con't.)
Technical Implementability Screening of Remediation Technologies and Process

West Lake Landfill OU-2 Feasibility Study

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Physical Treatment/ Pretreatment following Removal	Dewatering/Drying	Rotary drum, vacuum, and belt filtration; drying bed; filter press; pressure filtration; gravity thickening; centrifugation; and evaporation	Dewatering/drying can limit the mobility and reduce the total volume of contaminated material. These processes can be implemented with conventional methods.	Eliminated. No identified Hot Spots.
	Solids Separation	Classification (mechanical and non-mechanical); soil sorting and screening (wet/dry); floatation and gravity concentration/centrifugation; magnetic and paramagnetic separation; and electrostatic separation	Solids separation processes can limit the toxicity, mobility, and volume of contaminated material and mitigate potential exposures and migration. This technology could serve as a pretreatment step for a primary treatment process and it is considered developmental for waste treatment applications.	Eliminated. No identified Hot Spots.
	Volume Reduction	Impact crushers, shredders, pulverizers, tumbling and hammer mills, and compactors.	These processes can reduce the size and volume of contaminated material (e g., large chunks of soil or rock), which is often required as a pretreatment step for a primary treatment process (e.g., for a chemical extraction process).	Eliminated. No identified Hot Spots.
	Nonthermal Extraction	Aqueous soil washing in a reactor vessel	Soil can be mixed with water in a contact vessel to wash contaminants from the waste matrix but water alone is typically ineffective as a washing solution.	Eliminated. No identified Hot Spots.

LEGEND

[ ] Technology and/or Process Option Screened out on the basis of technical implementability.

★ Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-1 (con't.)
Technical Implementability Screening of Remediation Technologies and Process

West Lake Landfill OU-2 Feasibility Study

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Chemical Treatment Plant/ Pretreatment following Removal	Contract Extraction	Non-aqueous soil washing in a reactor vessel	Various solutions can be used to separate oils, organic compounds, and metals from soil in an agitated vessel.	Eliminated. No identified Hot Spots.
	Stabilization/Solidification	Lime-based and Portland cement-based pozzolanic reactions, asphalt-based thermoplastic microencapsulation, catalyzed polymerization, and silicate and adsorbent binding in a reactor vessel such as a pug mill blender	As described for the in-situ application except that process effectiveness is less constrained because various pretreatment options are available (e.g., dewatering and crushing) and the mix can be better controlled.	Eliminated. No identified Hot Spots.
Removal	Excavation	Backhoe, bulldozer, scraper and front-end loader	Excavation can limit contaminant mobility and mitigate potential exposures at the affected area by removing the contaminant source. This technology can be implemented with conventional equipment.	Eliminated. No identified Hot Spots.
Disposal	Offsite Disposal	Offsite disposal facility	This option would involve incorporation of removed material at an existing acceptable permitted commercial disposal facility. Land-based disposal can reduce the mobility of contaminated material and mitigate potential exposures and migration by controlling the contaminant source. In addition to engineering requirements, constraints include issues such as transportation routes and risks, costs for off-site disposal and regulator/community acceptance	Eliminated. No identified Hot Spots.

LEGEND

[ ] Technology and/or Process Option Screened out on the basis of technical implementability.

* Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-1 (con't.)
Technical Implementability Screening of Remediation Technologies and Process

West Lake Landfill OU-2 Feasibility Study

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	EFFECTIVENESS	IMPLEMENTABILITY	COST	SCREENING COMMENTS
No Action	None	None	Does not achieve all remedial action objectives	May be implemented with regulatory acceptance	No cost.	Provides a baseline for comparison with action alternatives.
Institutional Controls *	Access Restrictions	Fences and guards	The perimeter of the West Lake Landfill site is fenced, and entry to the West Lake Landfill is controlled at the landfill office/weigh station; these measures mitigate potential public exposure to contamination on-site by restricting entry. A six foot high chain-link fence with a three-strand barbed wire canopy encloses the entire West Lake Landfill. The main access gate is located on the northeastern perimeter, off of St. Charles Rock Road. An additional gate is located on the southwestern perimeter to provide access to the automobile repair shop.	Fences and other such measures are easy to implement, and resources are readily available	Low	Can effectively limit entry to contaminated areas and can be used to support other remedial actions, if any
	Proprietary Controls	Deed Restrictions	Covenant restrictions have been recorded by each of the owners against their respective parcels and the entire West Lake Landfill prohibiting residential use. Covenant restrictions cannot be terminated without the written approval of the then owners, the Missouri Department of Natural Resources (MDNR), and the EPA.	Deed restrictions are easy to implement, and resources are readily available	Low	Can minimize exposures to site contaminants by limiting use of contaminated areas and can be used to support other remedial actions, if any.
		Deed notices	Long-term effectiveness depends on continued future implementation.	Potentially implementable	Low	None

(continued on next page)

LEGEND

[ ] Technology and/or Process Option Screened out on the basis of technical implementability.

* Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-2
Evaluation of Remediation Technologies and Process Options

West Lake Landfill OU-2 Feasibility Study

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	EFFECTIVENESS	IMPLEMENTABILITY	COST	SCREENING COMMENTS
	(continued from previous page)					
		Easements	Long term effectiveness depends on continued future implementation.	Implementability will depend on activity to be undertaken under easement and ease of negotiation with landowner.	Moderate capital costs depending on extent of easements required Low O&M costs.	None.
		Covenants	Long term effectiveness depends on continued future implementation.	Potentially implementable	Low	None
		Groundwater use restrictions	Restrictive covenants recorded in June 1997 by each of the fee owners against their respective parcels prohibit use of groundwater from beneath the landfill. These deed restrictions cannot be terminated without the written approval of the then owners, the Missouri Department of Natural Resources (MDNR), and the EPA.	These measures are easy to implement, and resources are readily available	Low	Can minimize exposures to site contaminants by limiting use of contaminated areas and can be used to support other remedial actions, if any.
Monitoring	Monitoring	Groundwater, runoff, and landfill gas monitoring	This measure can support the mitigation of potential impacts by providing data on the nature and extent of contamination and the effectiveness of any remedial action.	Monitoring is easy to implement.	Low capital costs. Low to moderate O&M costs	Can provide data useful for minimizing exposures and can be used to support other remedial actions, if any
In-situ Containment	Surface Controls/ Diversions	Diversion/collection, grading, graded contours, swales and berms, and vegetation to isolate storm water from Areas 1 and 2	Diversions - such as graded contours, swales, or berms - can effectively reduce contaminant mobility at the Site.	Can be implemented with conventional equipment and procedures, and resources are readily available	Low	Can limit contaminant mobility by directing surface runoff around contaminated areas on-site.
	Surface Water/ Sediment Control Barriers	Sediment traps, Sedimentation basins	Sediment traps and sedimentation basins can limit mobility of contaminants in surface soil that may be mobilized via storm water run-on and run-off.	Can be implemented with conventional equipment and procedures, and resources are readily available.	Low to moderate capital costs Low O&M costs.	Can limit contaminant mobility by containing contaminated sediment on-site.
	Dust Controls	Revegetation, capping	Revegetation and capping can limit contaminant mobility and mitigate potential migration via air and stormwater by controlling particulate resuspension.	Can be implemented with conventional equipment and procedures, and resources are readily available.	Low to moderate capital costs. Low O&M costs	Can limit airborne emissions
	Capping and Covers *	Soil, clay, and vegetation; synthetic membrane material	Caps and covers can effectively reduce precipitation-enhanced percolation and leaching	Can be implemented with conventional equipment and procedures. Resources are readily available.	Moderate to high capital costs Moderate O&M costs.	Soil, clay and vegetation layer cover retained. Geosynthetic clay cover retained

LEGEND

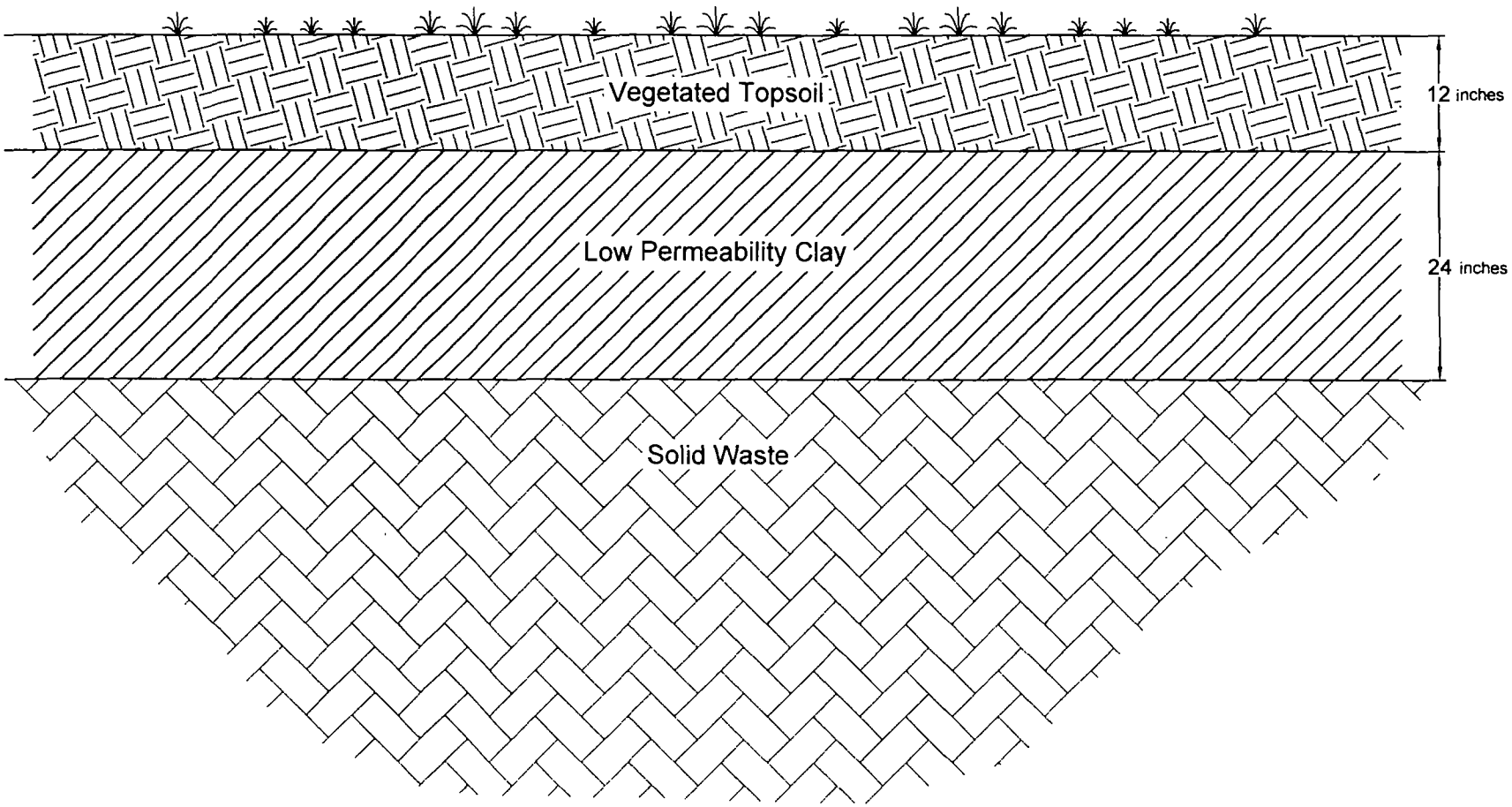
[ ] Technology and/or Process Option Screened out on the basis of technical implementability

* Indicates that General Response Action or remedial technology is component of presumptive remedy for CERCLA municipal landfill sites (USEPA, 1993)

Figure 4-2 (con't)
Evaluation of Remediation Technologies and Process Options

West Lake Landfill OU-2 Feasibility Study

Alternative 2
State of Missouri - Prescribed Cover

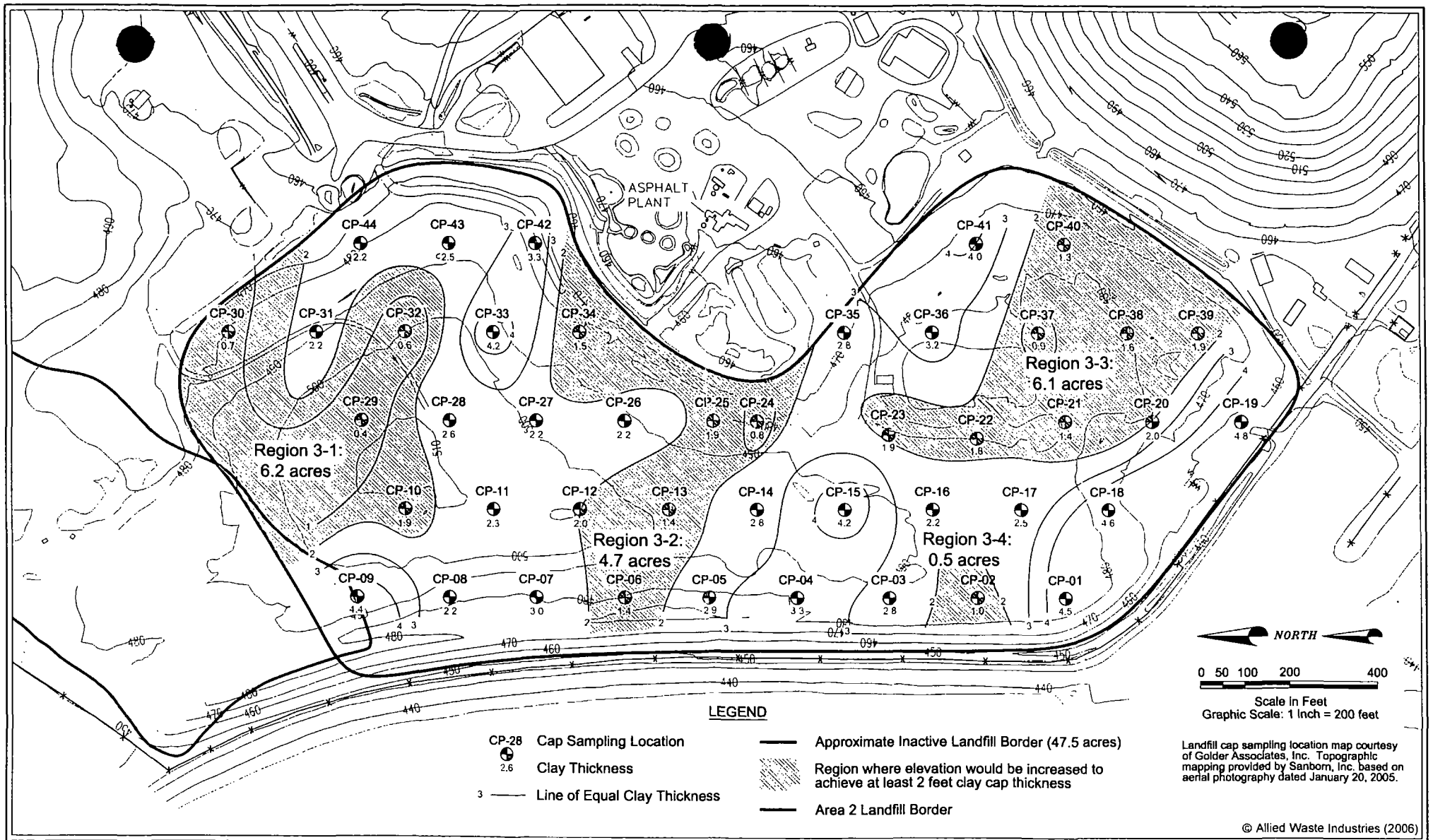


© Allied Waste Industries (2006)

4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.®

West Lake Landfill OU-2
Bridgeton, Missouri

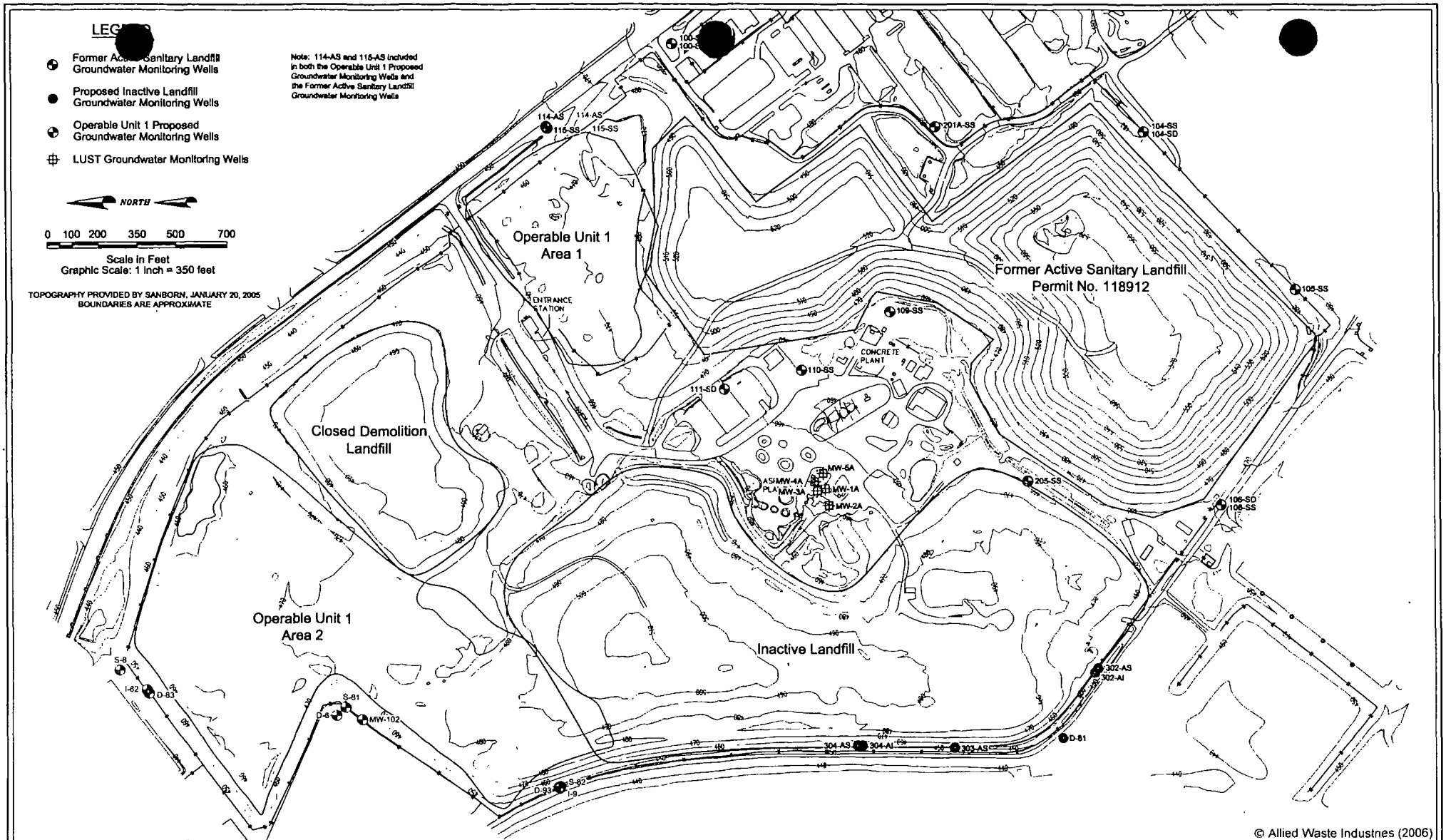
Figure 5-1
State of Missouri - Prescribed Cover
Cross-Section View



4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

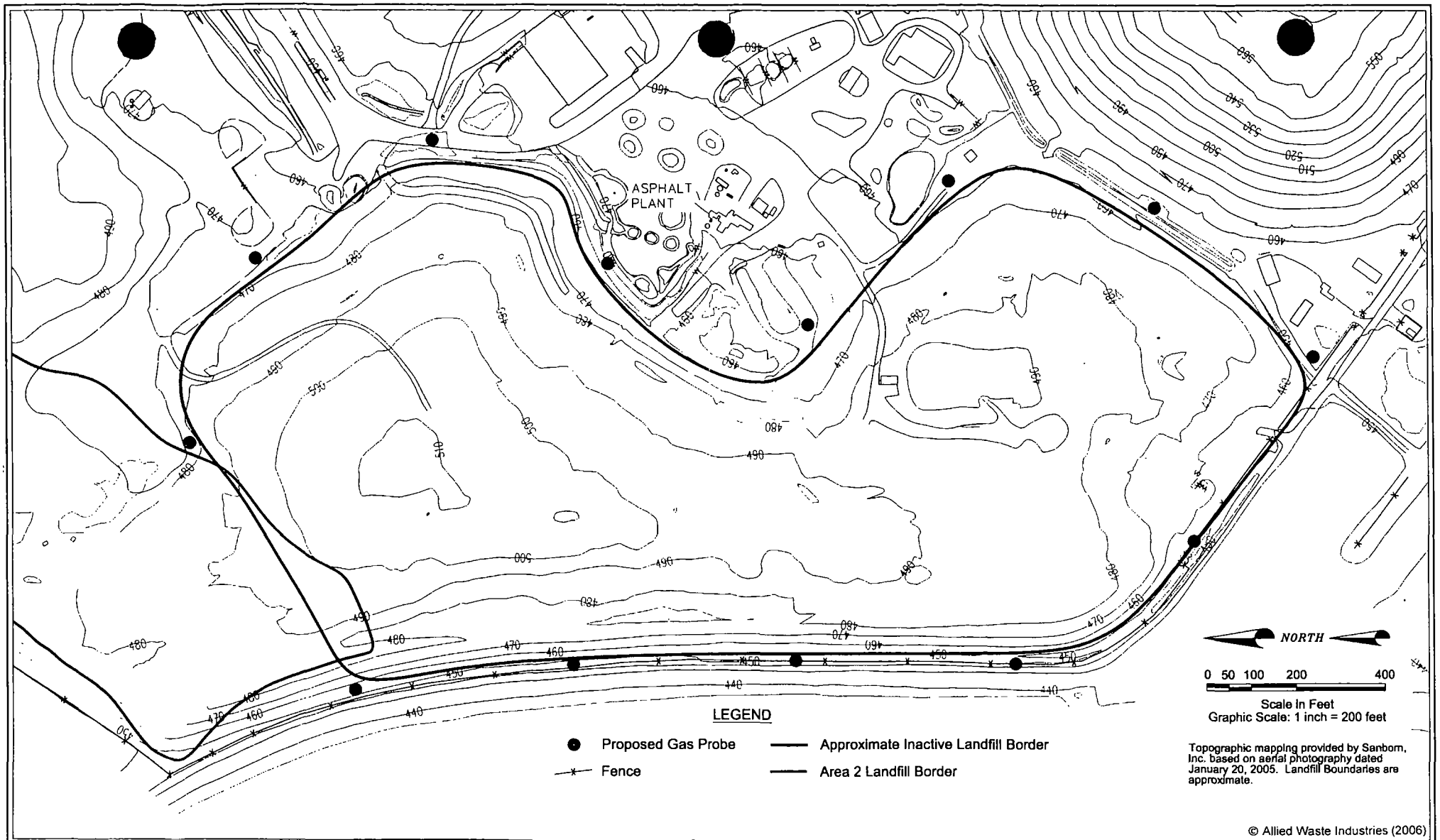
Figure 5-2
Alternative 2 - State of Missouri Prescribed Cover



HERST & ASSOCIATES, INC.
4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757

West Lake Landfill OU-2
Bridgeton, Missouri

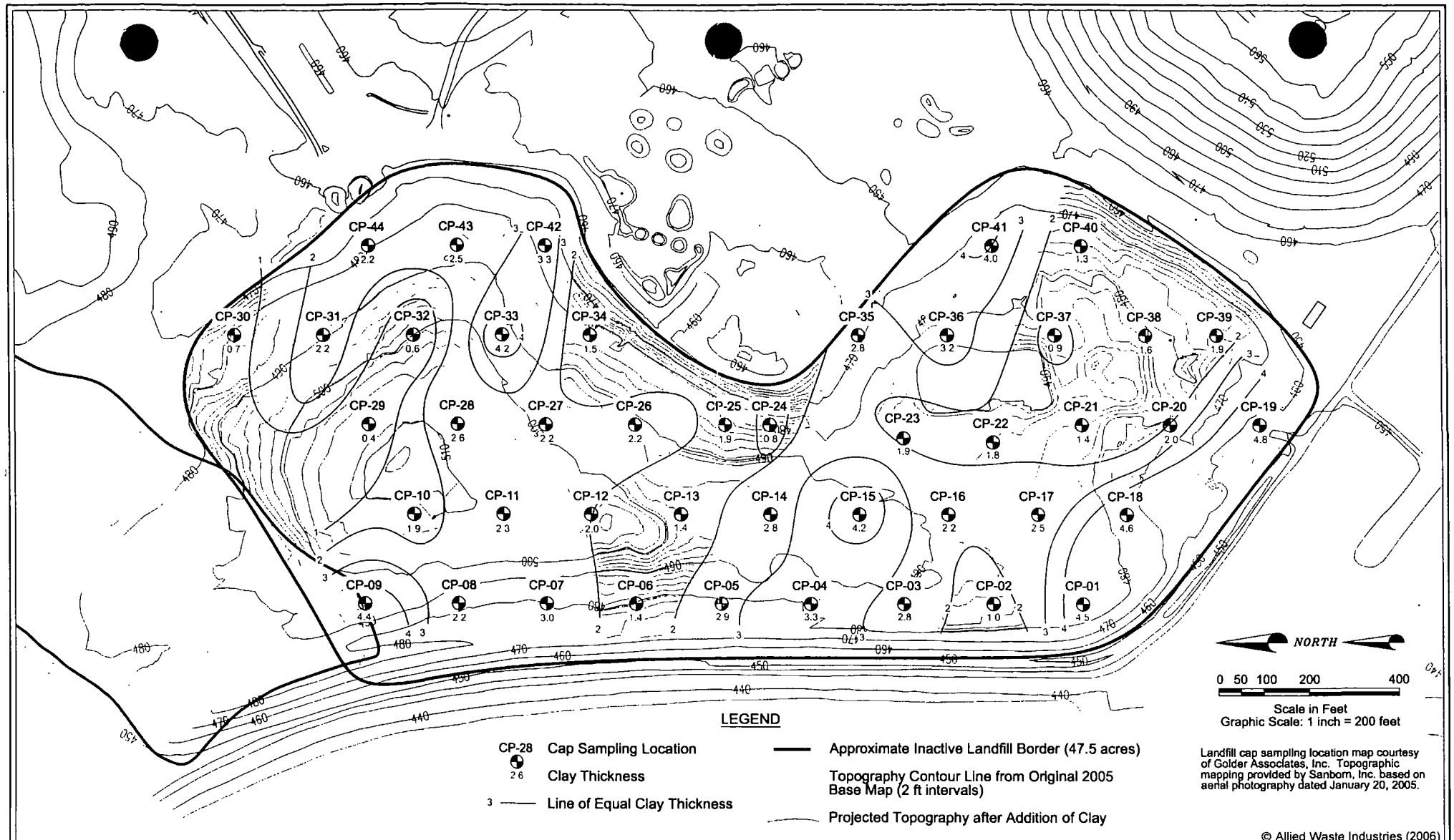
Figure 5-3
Site-Wide Groundwater Monitoring Well Locations



4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

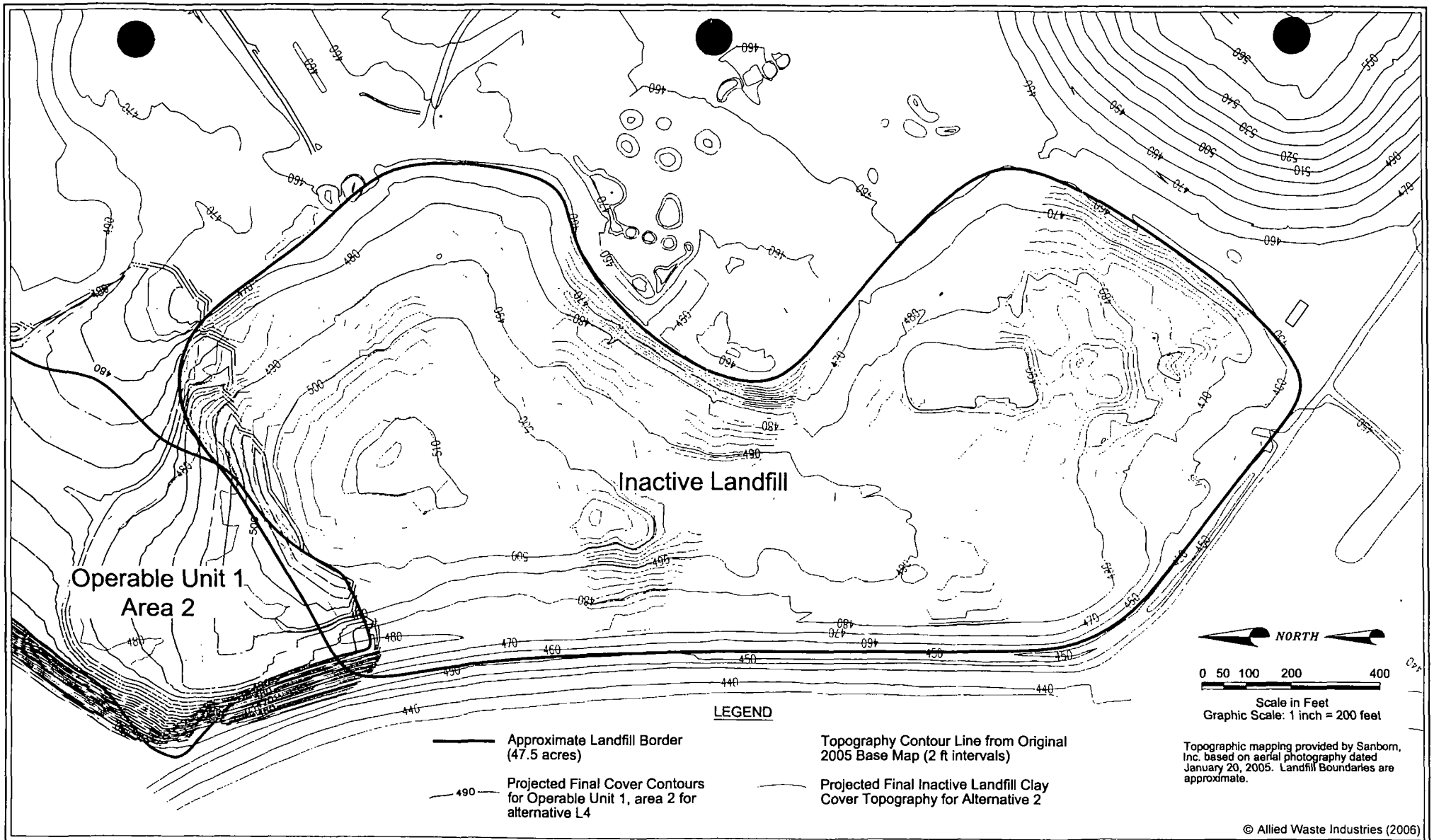
Figure 5-4
Proposed Perimeter Gas Probe Location Map
Approximately 500 ft spacing



4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939-9111
Fax (636) 939 9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 7-1
Alternative 2 - State of Missouri
Projected Topography



4630 South Highway 94
North Outer Road
St Charles, Missouri 63304
Phone (636) 939 9111
Fax (636) 939-9757
HERST & ASSOCIATES, INC.

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 7-2
Projected Final Cover Contours for the Inactive Landfill and Operable Unit 1 Area 2

APPENDICES

APPENDIX A

Closure/Post Closure Plan for Former Active Sanitary Landfill

BRIDGETON LANDFILL
- CLOSURE PLAN
1008

FILE
COPY

LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
SANITARY LANDFILL

CLOSURE AND POST-CLOSURE PLAN

December 1996
Revised September 1997

Prepared for:
LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI

Prepared by:
MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.
522 EAST CAPITOL AVENUE
JEFFERSON CITY MISSOURI
(573)636-9454

LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
SANITARY LANDFILL

CLOSURE AND POST-CLOSURE PLAN

December 1996
Revised April 1998

Prepared for:
LAIDLAW WASTE SYSTEMS (BRIDGETON), INC.
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI

Prepared by:
MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.
2014 WILLIAMS STREET
JEFFERSON CITY MISSOURI 65109
(573)636-9454

TABLE OF CONTENTS

I. Introduction 1

II. General Site Description 2

III. Closure Plan 4
- A. Final Cover System 5
  - 1. Final Cover 5
  - 2. Final Grading 5
  - 3. Seeding, Fertilizing and Mulching 6
  - 4. Final Cover QA/QC 6
- B. Gas Control System 6
- C. Leachate Control System 6
- D. Closure Certification 7
- E. Cost Estimate 8
  - 1. Design/Construction Contract Documents 8
  - 2. Final Cover System 8
  - 3. Gas Control System 9

IV. Post-Closure Plan 13
- A. Inspection and Maintenance 13
  - 1. Site Inspection 14
  - 2. Final Cover Repair 14
  - 3. Vegetation Cover Repair 15
  - 4. Groundwater Monitoring System 15
  - 5. Gas Control/Monitoring System 15
  - 6. Leachate Collection System 16
  - 7. Security System 16
- B. Land Use 17
- C. Recordkeeping 17
- D. Post-Closure Certification 17
- E. Corrective Action 17
- F. Cost Estimate 18
  - 1. Site Inspection and Recordkeeping 18
  - 2. Final Cover Repair 19
  - 3. Vegetation Cover Repair and Maintenance 19
  - 4. Groundwater Monitoring System 19
  - 5. Gas Control/Monitoring System 20
  - 6. Leachate Management System 22
  - 7. Security System 24

V. Financial Assurance 28

WLLFOIA4312 - 001 - 0053045

VI. Financial Assurance Instrument 29

WLLFOIA4312 - 001 - 0053046

LIST OF FIGURES

Figure 1 - General Highway Map 3

LIST OF TABLES

Table 1 - Closure Cost Summary 11

Table 2 - Unit Costs for Pump Maintenance 21

Table 3 - Post-Closure Cost Summary 25

I. INTRODUCTION

The Bridgeton Sanitary Landfill (Bridgeton SLF), which is owned and operated by the Laidlaw Waste Systems (Bridgeton), Inc. (LWS), is located approximately 0.75 miles north of Interstate 70 and immediately south of St. Charles Rock Road in St. Louis County. This landfill operates under Missouri Department of Natural Resources (MDNR) Solid Waste Disposal Operating Permit Number 118912, which was issued November 18, 1985, and the St. Louis County Department of Health (DOH) Permit Number 0418.

The purpose of this document is to provide a revised closure and post-closure plan for the Bridgeton SLF which conforms to 40 CFR Part 258 Subpart F, the Missouri Solid Waste Law section 260.226 and 260.227, and Missouri Regulations 10 CSR 80 and the St.Louis County Waste Management Code, Chapter 607.

Throughout this document the Bridgeton Sanitary Landfill is referred to as the *Bridgeton SLF* and Laidlaw Waste Systems (Bridgeton), Inc. is referred to as *LWS*.

II. GENERAL SITE DESCRIPTION

The Bridgeton SLF is located in U.S. Survey 131, Township 47 North, Range 5 West in St. Louis County, Missouri. The site is located approximately 0.75 miles north of U.S. Highway 70 and immediately south of St. Charles Rock Road (see Figure 1). The landfill site is located entirely within the City of Bridgeton.

The Bridgeton SLF has MDNR Permit No. 118912 and DOH License No. 0418 on a 214-acre tract of land of which 52 acres are used for landfilling. The facility upgrade and permit modification will similarly encompass 52 acres.

WLLFOIA4312 - 001 - 0053049

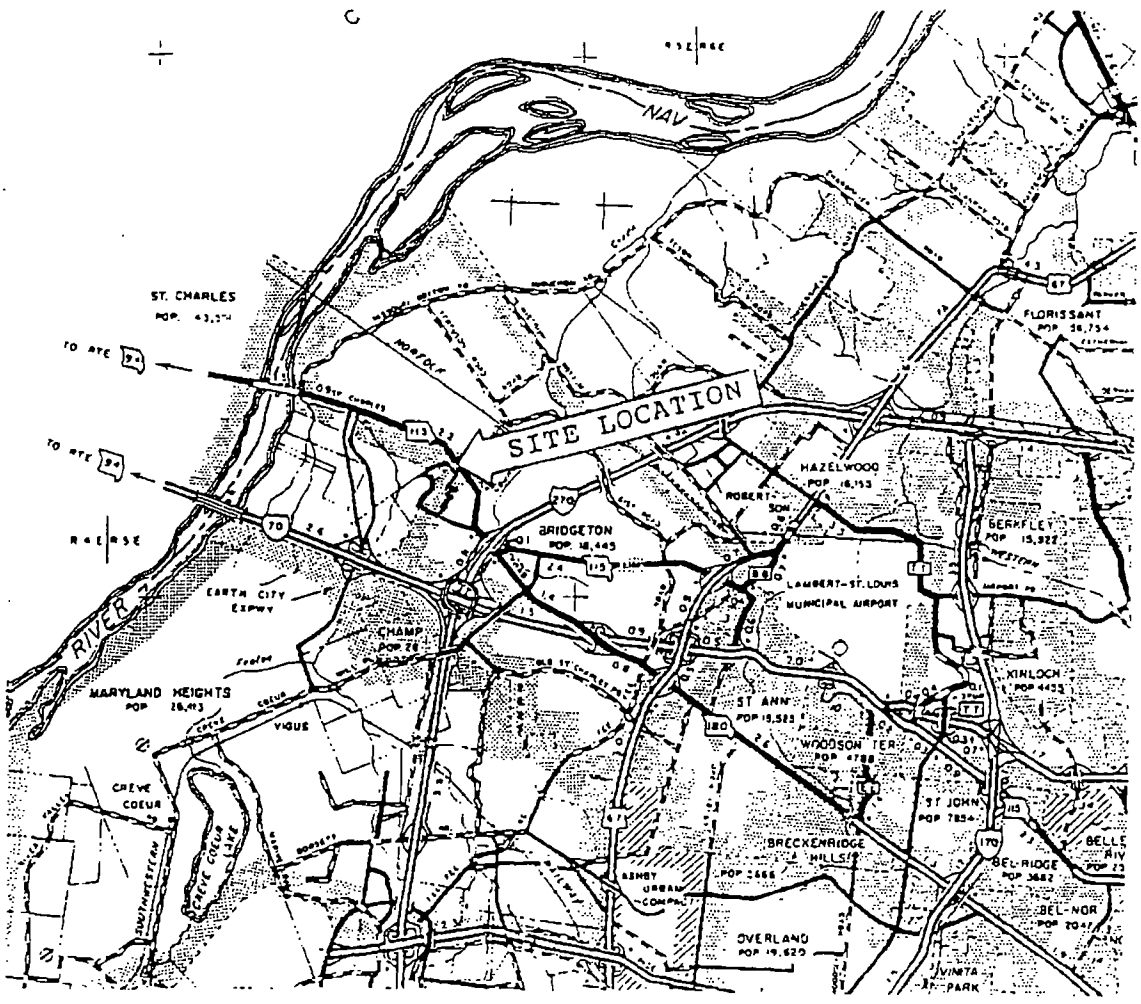
Project: Laidlaw Waste Systems (Bridgeton), Inc.
Facility Upgrade and Permit Modification

Project Number: 940130-004 Date: 12/96

MEC
MIDWEST ENVIRONMENTAL CONSULTANTS, P.C.

Figure 1
Scale: 1"= 2 miles
General Highway Map for St. Louis County

Longitude - 38° 46' 12"
Latitude - 92° 26' 34"



III. CLOSURE PLAN

In accordance with 260.226 RSMo, 10 CSR 80-2.030, and the St. LouisCounty Waste Management Code Chapter 607, sanitary landfills must have closure plans that outline the tasks and estimated costs which must be completed after the facility has ceased accepting waste.

The originally approved landfill design and operating procedures for the Bridgeton SLF utilized an area fill method, which is the current fill method. Refer to the Engineering Report for the planned sequence of fill.

MDNR will be notified in writing at least 180 days prior to the anticipated last receipt of waste. Upon closing the solid waste disposal area, the appropriate documents shall be recorded with the county recorder of deeds as required by 10 CSR 80-3.010 (17)(C)2 and the St. Louis County Waste Management Code Chapter 607.

The closure activities, which will be performed in accordance with the approved permit documents or as required by the promulgated rules, involve the following elements: (A) final cover system, (B) gas control system, (C) stormwater management system, (D) leachate management system, and (E) closure certification. These elements, along with specific closure tasks, are outlined in the following subsections. The final subsection addresses the cost estimates of these tasks.

A. Final Cover System

The following closure tasks are involved with the installation of a final cover system: (1) final cover, (2) final grading, and (3) final cover quality assurance/quality control (QA/QC).

1. Final Cover

The final cover system has been designed to comply with the design/construction requirements of final cover systems in 10 CSR 80-3.010 and the St. Louis County Waste Management Code Chapter 607. The final cover will cover approximately 52 acres with three (3) feet of soil. From bottom to top, this final cover system will consist of the following layers: (1) a two (2)-foot infiltration layer of compacted low permeability soil with a coefficient of permeability of 1×10^{-5} cm/sec or less, and (2) a one (1)-foot erosion layer of soil capable of sustaining vegetative growth.

The soil for the final cover system will come from the borrow area that is located just south of Old St. Charles Rock Road. The borrow area has a sufficient quantity of quality soil to provide for final cover.

2. Final Grading

The final cover will be graded and leveled to provide a suitable surface for promoting runoff, minimizing ponding, and establishing vegetation. The final contours will be graded to slope no steeper than 3:1 (horizontal to vertical) on the sideslopes and 10 percent on the crown. Landfill surface drainage structures are

included in the design of this site. See Plan Sheet 9 for the proposed final development plan of the landfill.

3. Seeding, Fertilizing and Mulching

The final cover will be seeded, fertilized, and mulched to establish vegetation.

4. Final Cover QA/QC

The QA/QC for final cover will include the following: (1) laboratory analysis to develop the compaction versus permeability relationship; (2) density tests every half (1/2) acre; (3) thickness measurements on approximately 100 feet centers; (4) surveying; and (5) soil testing every time the borrow location changes or work is discontinued for a given amount of time.

B. Gas Control System

The proposed final gas control system consists of numerous gas extraction wells, a piping system, a proprietary gas processing system, and a flare station. In addition, a portion of the existing gas control system will be incorporated into the final gas control system.

C. Leachate Control System

The leachate control system will be installed prior to the close of the landfill. The system will consist of six (6) sumps with pumps and necessary lines. Leachate is discharged to the St. Louis Metropolitan Sewer District (MSD) sewer system for disposal. It is estimated that the amount of leachate generated is 100 million gallons per year. Refer to the Engineering Report for additional information on the system.

D. Closure Certification

Upon completion of the closure activities, an independent professional engineer registered in the State of Missouri will certify that the landfill was closed in accordance with the closure plan. The certification will include the following items:

- An as-built drawing of the closed landfill which will be submitted to the MDNR within 180 days of initiating final closure.
- Verification of thickness of all final cover components on 100 feet centers with the locations identified on the as-built drawings.

Upon closure of the solid waste disposal area, the appropriate documents will be recorded with the St. Louis County Recorder of Deeds as required by 10 CSR 80-3.010(17)(C)2 and the St. Louis County Waste Management Code Chapter 607. The survey plat will include:

- The name of the property owner as it appears on the property deed;
- A detailed description of the property;
- The general types and location of the solid wastes and the depth(s) of fill within the property; and
- The location of any leachate control, gas control, or water monitoring systems which shall be maintained after closure and the length of time that these systems are to be maintained.

In accordance with 10 CSR 80-2.020(5)(J), LWS will execute an easement with the MDNR to enter the premises for closure, post-closure, or remedial action purposes. Also, LWS will submit to the MDNR a Notice and Convenant running with the land which has been recorded with the St. Louis County Recorder's Office.

WLLFOIA4312 - 001 - 0053054

E. Cost Estimate

The closure cost estimate will be adjusted every year based upon the actual rate of inflation for the proceeding year. The adjusted cost estimate will be submitted to the MDNR for review every year prior to the anniversary date of the permit. The rate of inflation will be the latest percent change in the implicit price deflator of the Gross Domestic Product as determined by the United States Department of Commerce.

Closure cost estimates are based on unit costs from the following sources: (1) Means Site Work and Landscape Cost Data, 1996 (Means) (2) vendor bids or quotes, and (3) MEC experience pertaining to landfills. All costs obtained using Means have been increased by 1.3 % for inflationary adjustments for 1997 dollars. A summary of these unit costs and the corresponding quantities are shown in Table 1 at the end of this section. The following subsections discuss the assumptions involved with these estimates.

1. Design/Construction Contract Documents

Based on MEC experience, the estimated cost associated with the preparation of closure design/construction contract and closure certification documents is $5,000.

2. Final Cover System

a. **Final Cover:** The following are estimated unit costs associated with purchasing and placing the final cover:

Item	Unit Cost
Excavating, Hauling, Spreading, & Compacting	$4.79/c.y.
Excavating, Hauling, & Spreading	$2.60/c.y.
Grading	$0.16/s.y.

The following are estimated quantities of the final cover elements:

Final Cover Elements	Quantity
Infiltration Layer (2')	164,560 c.y.
Erosion Layer (1')	83,893 c.y.

b. **Final Grading:** The unit cost utilized for final grading, which was obtained from Means, is $0.16/sq. yd. The quantity for final grading of the final cover systems is 251,680 sq. yds. (52 acres).

c. **Seeding, Fertilizing, and Mulching:** For cost estimating purposes, the final surface is assumed to be seeded, fertilized, and mulched using a hydroseeder. An assumed seeding rate of 5.5 pounds of tall fescue per 1,000 square feet will be used for cost estimating purposes and that fertilizer will be applied at 800 pounds per acre. The cost for hydroseeding is $43.60 per 1,000 square feet. The unit cost was taken from Means. At the time of closure, soil testing will be performed to determine actual seeding and fertilizer rates and types.

d. **Final Cover Quality Assurance/Quality Control (QA/QC):** Final cover QA/QC costs are estimated to be $300 per acre by Mr. Dan Klockow, DEKA Geotechnical, Columbia, Missouri.

3. Gas Control System

The estimated unit cost of installation of the proposed gas control wells and piping system is $10,000 per acre. In addition, a blower/flare station should be included in

the closure costs in the event that the gas is no longer recovered for beneficial use. A blower/flare station includes a condensate management system, blowers, and flare systems. The cost estimate of a condensate management system is $5,000. Four centrifugal blowers providing a flow capacity of approximately 2,500 scfm would be required. The estimated unit cost of each blower is $20,000. Three enclosed flare systems providing a combined capacity of approximately 10,000 scfm would be required. The estimated unit cost of each flare system is $125,000. The estimated cost of the foundation required for the blower/flare station is $30,000. These cost estimates are based on MEC and LWS experience.

TABLE 1
CLOSURE COST SUMMARY

Bridgeton Sanitary Landfill

St. Louis, Missouri

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
1. DESIGN/CONSTRUCTION CONTRACT AND CLOSURE CERTIFICATION DOCUMENTS:				
a. Preparation of Documents	1	event	$5,000	5,000
SUBTOTAL				**$5,000**
2. FINAL COVER SYSTEMS:				
a. Infiltration Layer				
Excavation, Hauling, Spreading, & Compacting	164,560	cu. yd.	4.79	788,242
b. Erosion Layer				
Excavation, Hauling, & Spreading	83,893	cu. yd.	2.60	218,122
Grading	251,680	sq. yd.	0.16	40,269
c. Vegetation				
Hydroseeding	2,265	MSF	43.60	98,754
d. Construction Quality Assurance				
Inspection and Testing	52	acre	300	15,600
CQA Manual/Certification Report	1	event	500	500
SUBTOTAL				**$1,161,487**

TABLE 1
CLOSURE COST SUMMARY

Bridgeton Sanitary Landfill

St. Louis, Missouri

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
3. GAS EXTRACTION / MONITORING SYSTEM:				
a. Installation of Collection System				
Gas Control Wells & Piping System	51.0	acre	10,000	510,000
b. Installation of Blower/Flare Station				
Condensate Management System	1	each	5,000	5,000
Blowers	4	each	20,000	80,000
Flare and Controls	3	each	125,000	375,000
Foundation	1	each	30,000	30,000
c. Construction Quality Assurance				
Inspection and Testing	1	event	4,000	4,000
CQA Manual/Certification Report	1	event	1,000	1,000
SUBTOTAL				**$1,005,000**
TOTAL COSTS				**$2,171,487**

IV. POST-CLOSURE PLAN

In accordance with 260.227 through 260.228 RSMo, 10 CSR 80-2.030, and the St. Louis County Waste Management Code Chapter 607, sanitary landfills are required to submit post-closure plans and financial assurance for post-closure maintenance activities. The purpose of the post-closure plan is to provide a description of the monitoring and maintenance activities required during the 30-year post-closure period. The post-closure plan should also address the frequencies at which these activities will be performed as well as their respective costs.

The first five sections of this post-closure plan addresses the following post-closure issues: (A) inspection and maintenance; (B) land use; (C) recordkeeping; (D) post-closure certification; and (E) corrective action. The final section addresses the cost estimate of the required post-closure activities.

A. Inspection and Maintenance

Inspection and maintenance of the landfill will be performed on a quarterly basis, unless noted otherwise. However, additional inspections may be necessary as a result of severe weather conditions. This section addresses the following inspection and/or maintenance activities: (1) site inspection; (2) final cover repair, (3) vegetation cover repair, (4) groundwater monitoring system; (5) gas control/monitoring system; (6) leachate management system; and (7) security system.

1. Site Inspection

This activity requires eight (8) hours per quarter for one individual to visually inspect and document the site's condition. This activity is critical for making decisions regarding the following four (4) inspection and/or maintenance activities.

2. Final Cover Repair

Maintaining an intact final cover system is necessary to minimize infiltration into the landfill. Therefore, inspection of the final cover should address, at a minimum, the following: (1) settlement; (2) erosion; (3) surficial cracking; and (4) animal burrows. Final cover repair maintenance activities should be performed as soon as possible to minimize infiltration.

With respect to surficial cracking, the operator will adhere to the following criteria:

a. The operator will repair surficial cracking within one (1) week of identifying that it has occurred, regardless of weather conditions.

b. The materials used for repair shall be compacted clay overlain with a vegetative soil layer consistent with the approved cap design.

c. A registered professional engineer shall certify that the repairs have been completed in accordance with this section. Certifications shall be included in the records maintained in accordance with Section IV. C.

3. Vegetation Cover Repair

Maintaining a healthy vegetation cover helps reduce erosion and infiltration. Therefore, inspection of the vegetation cover should address, at a minimum, the following: (1) erosion; (2) growth of woody species; and (3) dead vegetation. Vegetation cover repair maintenance includes mowing, removing undesirable plant species, reseeding, fertilizing, and mulching. Maintenance should be performed as soon as possible to maintain a good vegetation cover.

4. Groundwater Monitoring System

Inspection of the groundwater monitoring system should include, but not be limited to, the following activities: (1) checking for blockage; (2) checking the integrity of the concrete apron and protective housing; (3) redeveloping of the wells, if necessary; and (4) conducting groundwater sampling and analysis. Groundwater monitoring system maintenance activities should be performed as soon as possible to maintain the groundwater monitoring program.

5. Gas Control/Monitoring System

The gas control/monitoring system must be maintained to ensure that the system performs as designed. Inspection of the gas control/monitoring system should include, but not be limited to, checking for exterior damage and checking for blockage.

The gas control system should be inspected at least weekly to ensure proper operation. This inspection should include monitoring of gas composition,

WLLFOIA4312 - 001 - 0053062

temperature, and flow, and wellhead and system pressure. This data should be utilized to make adjustments to the well field. All mechanical components should also be inspected.

Gas will be monitored to ensure that the concentration of methane does not exceed 25 percent of the lower explosive limit in facility structures and does not exceed 5 percent of the lower explosive limit at the facility property boundary. Gas monitoring will be performed at each of the five (5) monitoring probes and in all structures. A portable methane meter will be utilized for monitoring. Monitoring activities may be supplemented by bar punch monitoring of shallow soils.

6. Leachate Collection System

The leachate collection system must be maintained to ensure that the system is performing as designed. The inspection should include, but not limited to, the following activities: (1) checking collection lines for blockage; (2) checking the operation of the pumps; (3) checking leachate levels in sumps; and (4) conducting leachate sampling and analysis. Maintenance of the leachate collection system should be performed as soon as possible to keep the system performing as designed.

7. Security System

The integrity of the security system fence must be maintained to prevent vandalism at the site.

B. Land Use

The landfill area will be maintained as a closed landfill with no other anticipated use.

C. Recordkeeping

Recordkeeping of post-closure monitoring reports, inspection reports, and maintenance and repair reports will be kept at a location determined at the time of closure. The contact person during the post-closure period will be determined at the time of closure.

D. Post-Closure Certification

Following completion of the post-closure care period, a certification signed by an independent professional engineer registered in the State of Missouri will be submitted to the MDNR. This certification will verify that the post-closure care has been completed in accordance with the post-closure plan and it will be placed in LWS's Operating Record.

E. Corrective Action

If statistical testing of groundwater, as required by 10 CSR 80-3.010(8), identifies significant evidence of contamination, an assessment of corrective measures will be initiated and corrective action will be taken in accordance with 10 CSR 80-3.010(9). The financial assurance requirements for the corrective action will be developed at that time in accordance with 10 CSR 80-2.030(4). The cost for corrective action will account for the total costs of the activities as described in the corrective action plan for the entire corrective action period.

F. Cost Estimate

The post-closure cost estimate, which will be adjusted every year based upon the actual rate of inflation for the preceding year, will be submitted to the MDNR for review every year after the date of permit issuance. The rate of inflation will be the latest percent change in the implicit price deflator of the Gross Domestic Product as determined by the United States Department of Commerce.

Post-closure estimates are based on unit costs from the following sources: (1) Means Site Work and Landscape Cost Data, 1996 (Means), (2) vendor bids or quotes, and (3) MEC experience with landfills. All costs obtained using Means have been increased by 1.3% for inflationary adjustments for 1997 dollars. A summary of these unit costs and the corresponding quantities are shown on Table 3 at the end of this section. The following subsections discuss the assumptions involved with these estimates.

1. Site Inspection and Recordkeeping

This task will require one individual (technician at $50/hr) to spend eight (8) hours per quarter visually inspecting and documenting the condition of the site. An eight (8)-hour period will provide sufficient time to travel to and from the site and to conduct a walkover inspection.

Recordkeeping will be required to document the tasks performed throughout the year. It is assumed that the completion of this report will take eight (8) hours of preparation by a technician to write, one (1) hour for a project manager to review, and two (2)

hours for a secretary to type. Based on current billing rates, quarterly recordkeeping should require $525.

2. Final Cover Repair

It is assumed that there will be a need for the replacement of one foot (1') of cover soil over 5 percent of the landfill each year due to erosion, settlement, and other factors. The unit costs used for this task (Hauling & Spreading, and Grading) are based on Means.

3. Vegetation Cover Repair and Maintenance

It is assumed that reseeding will be necessary over 10 percent of the landfill each year. There are approximately 52 acres or 2,265,120 square feet (equivalent to 2,265 MSF) of landfill surface area under the facility upgrade/permit modification. The unit costs used for this task (Mowing, Seeding, Fertilizing, and Mulching) are based on Means. For seeding, it is assumed that tall fescue will be applied at 5.5 pounds per 1,000 square feet. For fertilizing, it is assumed that 800 pounds per acre will be used. For mowing, it is assumed that a tractor with a 5-gang reel mower or similar equipment will be used. The estimated unit cost of mowing based on Means is $0.43 per MSF. Mowing should be performed twice a year.

4. Groundwater Monitoring System

The groundwater monitoring system has been approved by MDNR. For purposes of this plan, it is assumed the groundwater monitoring program will consist of, twenty-five (25) monitoring wells for the duration of post-closure.

The post-closure maintenance cost is assumed to include the replacement of a well and each concrete apron every ten (10) years, and the redevelopment and reconditioning for each well every five (5) years. The following are estimated costs of each: well replacement which includes closure of the well being replaced - $10,000; apron repair - $300; and redevelopment & reconditioning - $250. These cost estimates were provided by Golder & Associates. Monitoring of groundwater is assumed to cost approximately $600 per well per semi-annual event. This includes pulling samples, QA/QC, and analysis. Reporting costs are estimated at $400 per year.

5. Gas Control/Monitoring System

Gas monitoring will be conducted at least quarterly. A monitoring event will require the involvement of a field technician, a project manager, and a secretary. The gas monitoring system will consist of five (5) gas probes, bar bunch monitoring, and building monitoring. The unit costs, estimated hours, and roles of different personnel are estimated as follows:

- *Technician*
  Unit Cost: $50/hour
  Estimated Hours: 32 hours/quarter
  Role: inspection preparation, inspection, and writing the report

- *Project Manager*
  Unit Cost: $75/hour
  Estimated Hours: 2 hours per quarter
  Role: reviewing the report

- *Secretary*
  Unit Cost: $20/hour

Estimated Hours: 2 hours per quarter
Role: typing report

Post-closure maintenance costs of the monitoring probes are assumed to include the replacement of one (1) well apron every ten (10) years. Based on previous experience, apron replacement cost is estimated to be $200.

Weekly inspection and control of the gas control system will be performed. These events will require approximately eight hours of labor by a technician. The unit cost for the labor is $50/hour.

Post-closure maintenance of the gas control system will include replacement of damaged wells and maintenance of the blowers. Replacement of 5% of the wellfield each year is assumed. The estimated unit cost of well installation is approximately $3,000. For estimation purposes, two 25-horsepower blowers are assumed to be operated during post-closure since operation of some blowers will discontinue as gas generation decreases. The blowers will probably need rebuilding twice during post-closure, costing approximately $6,500 per event. Annual power consumption will be approximately 350,000 kw-hr. Condensate will be disposal of as leachate at a unit cost of $0.99 per 100 cubic feet. An average post-closure condensate generation of 498,000 gallons per year is expected.

6. Leachate Management System

Maintenance activities involving the leachate management system include pump maintenance, hydroflushing of the leachate collection lines, discharge, sampling, and analysis.

a. Pump Maintenance

The following pump maintenance cost estimates (Table 2) were supplied by Richard Koch, Van Devanter Engineering. The pumps consist of two 58 horsepower (HP) pumps, two 22 HP Pumps, and two 13 HP pumps.

Table 2
Unit Costs for Pump Maintenance

	Unit Costs Per Pump		
Pump Maintenance Activity	**58 HP**	**22 HP**	**13 HP**
Replace each pump every 10 years	$25,000	$10,000	$6,000
Major overhaul every 5 years	$7,000	$4,500	$3,000
Minor overhaul every 2.5 years	$2,500	$2,250	$1,500
Replace each control panel for each pump every 15 years	$4,000	$3,000	$2,500
Semi-annual service for each pump	$400	$400	$400

To service or replace the pumps, the pumps must be removed from the sumps. According to Bridgeton SLF personnel, it takes approximately six (6) hours to remove and return the pump to the sump at a cost of $250/hour.

b. Hydroflushing the Leachate Collection Lines

Leachate collection lines may need to be cleaned if blockage occurs. It is recommended that a hydrojet flusher be used to clean the lines. It is assumed that the lines could be cleaned in 16 hours. The hydroflush cost is $75.00 per hour.

c. Discharge

The leachate generated on site is discharged to the St. Louis Metropolitan Sewer District (MSD). The leachate discharge cost is $1.05 per 100 cubic feet. It is estimated that 78 million gallons of leachate will be collected and discharged annually at the landfill.

d. Sampling

Samples, which are collected on a quarterly basis, are estimated to cost $50 according to SCS Engineers, who will perform leachate sampling.

e. Analysis

MSD requires the following parameters to be analyzed for on a quarterly basis:

pH	nickel
biochemical oxygen demand	zinc
chemical oxygen demand	iron
cadmium	total suspended solid
chromium	oil and grease
copper	temperature
lead	

Total toxic organics are to be analyzed annually. Quarterly analysis costs will be $135 and the annual analysis cost will be $613. There will be no costs for reporting. These costs were prepared by Quantera Environmental Services, North Canton, Ohio, who will be performing the analyses.

f. Utilities

During post-closure the same or similar leachate extraction pumps will be used. Four Union Electric account numbers were identified by Bridgeton SLF personnel. The total electric billing from September 1994 to August 1995 the four account numbers was approximately $49,300. It is assumed the similar costs will be incurred during post-closure.

7. Security System

Maintenance of the security system would involve fence repair. It is assumed that 100 feet of fence are damaged by vandalism or natural causes annually. The estimated unit cost of fence repair based on Means is $15.70 per linear feet (LF).

WLLFOIA4312 - 001 - 0053071

TABLE 3
POST-CLOSURE COST SUMMARY

Bridgeton Sanitary Landfill
St.Louis, Missouri

ITEM	YEARS	QUANTITY	UNITS	UNIT COST	ANNUAL TOTAL
1. SITE INSPECTION AND RECORDKEEPING:					
a. Site Inspection	30	4	event	$400	1,600
b. Recordkeeping	30	4	event	525	2,100
SUBTOTAL					**$3,700**
2. FINAL COVER REPAIR:					
Excavation, Hauling, & Spreading	30	4,195	cu. yd.	2.60	10,907
Grading	30	12,584	sq. yd.	0.16	2,013
SUBTOTAL					**$12,920**
3. VEGETATION COVER REPAIR:					
a. Control and Up-Keep					
Mowing	30	4,530	MSF	0.43	1,948
b. Re-Vegetation					
Seeding	30	227	MSF	18.18	4,127
Fertilizer	30	2.08	ton	391	813
SUBTOTAL					**$6,888**
4. GROUNDWATER MONITORING SYSTEM:					
a. Maintenance/Repairs					
Apron Repair	30	2.5	event	300	750
Redevelopment & Reconditioning	30	5.0	event	250	1,250
Well Replacement	30	0.6	event	10,000	6,000
b. Monitoring and Reporting					
Monitoring	30	50	event	600	30,000
Reporting	30	1	annual	400	400
SUBTOTAL					**$38,400**

TABLE 3
POST-CLOSURE COST SUMMARY

Bridgeton Sanitary Landfill
St.Louis, Missouri

ITEM	YEARS	QUANTITY	UNITS	UNIT COST	ANNUAL TOTAL
5. GAS CONTROL / MONITORING SYSTEM:					
a. Monitoring & Monitoring System Maintenance					
Reporting	30	4	event	1,790	7,160
Maintenance	30	0.5	each	200	100
b. Control System Inspection & Maintenance					
Inspection	30	52	each	400	20,800
Well Replacement	30	2.5	each	3,000	7,500
Blower Rebuild	30	0.13	each	6,500	845
c. Operating Costs					
Utilities	30	350,000	kWh	0.07	24,500
Professional Services	30	4	event	1,500	6,000
d. Condensate Disposal					
Disposal	30	666	100 cu. ft.	0.99	659
SUBTOTAL					$67,564
6. LEACHATE MANAGEMENT:					
a. Maintenance/Repairs:					
System Cleanout	30	1	event	1,200	1,200
Pump Replacement	30	1	event	8,200	8,200
Pump Maintenance	30	2	event	2,400	4,800
Pump Major Overhaul	30	1	event	5,800	5,800
Pump Minor Overhaul	30	1	event	5,400	5,400
Control Panel	30	1	event	1,270	1,270
Pump Extraction	30	1	event	900	900
b. Operating Costs					
Utilities	30	1	year	49,300	49,300
c. Disposal Costs					
Disposal	30	104,300	CCF	1.05	109,515
d. Sampling, Testing, and Reporting					
Sampling	30	4	event	200	200
Quarterly Test	30	4	sample	135	135
Annual Test	30	1	sample	613	613
Reporting	30	4	event	No Cost	0
SUBTOTAL					$187,333

TABLE 3
POST-CLOSURE COST SUMMARY

Bridgeton Sanitary Landfill
St.Louis, Missouri

ITEM	YEARS	QUANTITY	UNITS	UNIT COST	ANNUAL TOTAL
7. SECURITY					
a. Fence Repair	30	100	LF/year	16.25	1,625
SUBTOTAL					$1,625
ANNUAL TOTAL					$318,431
THIRTY YEAR TOTAL					$9,552,925

* To Be Provided By Laidlaw Waste Systems

V. FINANCIAL ASSURANCE

In accordance with 10 CSR 80-2.030, a financial assurance instrument (FAI) must be filed with MDNR to ensure that proper closure and post-closure will take place should the operator be unable or unwilling to properly close the facility. In accordance with 10 CSR 80-2.030, an operator is required to obligate 100 percent of the total cost for closure and post-closure. Thereafter, the operator is required to adjust the cost estimates on an annual basis.

Closure Funds: The cost of closing the entire landfill (approximately 52 acres) in 1997 dollars is estimated to be $2,171,487. This cost represents the maximum amount of closure assurance needed if the entire 52 acres (approximate) of landfill were open when the last volume of solid waste was deposited in the landfill. Refer to Table 1, Closure Cost Summary.

Post-Closure Fund: A total of 52 acres will require post-closure maintenance and monitoring for 30 years. Post-closure cost for the landfill is estimated to be $318,431 per year ($9,552,925 over 30 years). Refer to Table 3, Post-Closure Cost Summary.

WLLFOIA4312 - 001 - 0053075

VI. FINANCIAL ASSURANCE INSTRUMENT

This report has provided the closure plan, the post-closure plan, and the respective financial assurance obligations.

Should this report and proposed facility upgrade and permit modification be approved, LWS will provide a total obligation in the following amount:

Closure Funding	$2,171,487
Post-Closure Funding	$9,552,925
Total Funding	$11,724,412

The closure and post-closure costs estimates will be adjusted every year based upon the actual rate of inflation based on the implicit price deflator of the Gross Domestic Product as determined by the United State Department of Commerce for the preceding year. The adjusted cost estimate will be submitted to MDNR for review every year prior to the anniversary date of the permit.

FEB 13

February 11, 1998

CERTIFIED MAIL

St. Louis County
Department of Health

Mr. Matt Kingsley
Laidlaw Waste Systems, Inc.
13570 St. Charles Rock Road
Bridgeton, MO 63044

Dear Mr. Kingsley:

The St. Louis Department of Health (DOH), Waste Management Section, has completed its review of the two volume "Facility Upgrade and Permit Modification" and plan sheets received March 6,1997. The submittal was prepared by Mr. Lee Tharp, P.E. of Midwest Environmental Consultants, P.C., on behalf of Laidlaw Waste Systems (Bridgeton). The plan submittal serves to consolidate and supersede all previous documents and proposes various changes involving gas, leachate, stormwater, final contours, and settlement to improve the long-term stability of the landfill. Due to the technical nature of hydrogeologic issues in reference to the proposed increase in static leachate head, the DOH has deferred final approval to the Missouri Department of Natural Resources (MDNR) and the Division of Geology and Land Survey (DGLS).

The DOH has received and reviewed the following documents relating to this facility upgrade and permit modification submittal in accordance with the St. Louis County Waste Management Code, Chapter 607:

1. Facility Upgrade and Permit Modification for the Laidlaw Waste Systems (Bridgeton), Inc. Sanitary Landfill, MDNR Permit Number 118912, Saint Louis County License Number 419, Saint Louis County, Missouri, December 1996, Volumes I and II, submitted by Midwest Environmental Consultants, P.C.

2. A set of twenty-four (24) plan sheets entitled Laidlaw Waste Systems (Bridgeton), Inc. Sanitary Landfill, Facility Upgrade and Permit Modification, MDNR Permit Number 118912, Saint Louis County License Number 419, Saint Louis County, Missouri, December 1996, Volumes I and II, submitted by Midwest Environmental Consultants, P.C.

3. Comment letter dated July 7, 1997 from Messrs. Steven Wyatt and Russell Seedyk, Jr. (MDNR Solid Waste Management Program) to Mr. Larry Giroux, Laidlaw Waste Systems (Bridgeton), Inc.

Buzz Westfall
County Executive

Paula Livingston-Thomas
DDS, MPH
Director

111 S. Meramec Avenue
Clayton, Missouri 63105

Phone: (314) 854-6000
Fax: (314) 854-6435
TDD: (314) 854-6446

An equal opportunity employer

4. Cover letter and comments dated October 31, 1997 from Mr. Lee Tharp, Midwest Environmental Consultants, P.C. to Mr. Steven Wyatt, MDNR Solid Waste Management Program, responding to the MDNR July 7, 1997-letter.

5. Revised Plan Sheet 8 of 24 entitled Laidlaw Waste Systems (Bridgeton), Inc. Sanitary Landfill Facility Upgrade and Permit Modification, Leachate Collection System and Details signed and sealed by Lee Tharp, P.E., Midwest Environmental Consultants, P.C. on October 31, 1997.

6. Revised Plan Sheet 12 of 24 entitled Laidlaw Waste Systems (Bridgeton), Inc. Sanitary Landfill Facility Upgrade and Permit Modification, Cross Section 3+00 - 5+00 signed and sealed by Lee Tharp, P.E., Midwest Environmental Consultants, P.C. on October 31, 1997

7. Memorandum entitled Addendum, ID.# F013-98 and dated 11/4/97 from Mr. David Erickson, DGLS-MDNR to Mr. Steven Wyatt, MDNR Solid Waste Management Program.

8. Letter dated December 12, 1997 and received via a facsimile on February 4, 1998 from Mr. Lee Tharp, Midwest Environmental Consultants, P.C. to Ms. Susan Taylor, DOH, in response to the November 26, 1997 comment letter from DOH to Mr. Matt Kingsley, Laidlaw Waste Systems (Bridgeton), Inc.

9. Revisions to the Facility Upgrade and Permit Modification for the Laidlaw Waste Systems (Bridgeton), Inc. Sanitary Landfill submitted by Mr. Lee Tharp, Midwest Environmental Consultants, P.C. to DOH and received via a facsimile on February 4, 1998.

   a. Pages 1, 2, 10, 11, 14, 46, and 57.
   b. Waste Exclusion Plan for the Bridgeton Landfill dated October 1993.

DOH is hereby granting approval for this modification contingent upon the receipt of a final plan document by DOH on or before February 25, 1998. This document shall include all approved changes and shall appropriately reference DOH in the text, to review, approve and receive notification and submittals of data/information in accordance with the St. Louis County Waste Management Code, Chapter 607.

This approval is not to be construed as compliance with any existing federal. state, or local environmental laws other than the St. Louis County Waste Management Code, Chapter 607; nor should it be construed as a waiver for other regulatory requirements. This approval is not to be construed as compliance with any existing local ordinances or zoning requirements.

DOH reserves the right to revoke, suspend, or modify this approval and/or license #419, after due notice, if the license holder fails to maintain the facility in compliance with St. Louis County's Waste Management Code, the terms and conditions of the license, and the approved engineering plans and specifications.

Should you have any questions regarding the comments provided, please contact me at 854-6919 or Brad Bomanz at 854-6249.

Sincerely,

Susan R. Taylor, Supervisor
Waste Management Section

SRT/eh

cc: Lee Tharp, Midwest Environmental Consultants
Chuck Ketring, Laidlaw Waste Systems, Inc.
Steve Wyatt, MDNR-SWMP
Scott Waltrip, MDNR-SWMP
Richard Houchin, City of Bridgeton
Conn Roden, Director, Division of Environmental Protection, DOH
Joan Bradford, Manager, Office of the Solid Waste Coordinator

STATE OF MISSOURI
Mel Carnahan, Governor • Stephen M. Mahfood, Director
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF THE DIRECTOR
P.O. Box 176 Jefferson City, MO 65102-0176

MAR 23 1998

CERTIFIED MAIL # Z 289 843 581
RETURN RECEIPT REQUESTED

Mr. Greg Ribaudo
District Manager
Bridgeton Landfill Authority
12976 St. Charles Rock Road
Bridgeton, MO 63044

RE: Facility Upgrade Package and Permit Modification, Bridgeton Sanitary Landfill, Permit Number 118912, St. Louis County

Dear Mr. Ribaudo:

On March 3, 1997, the Department of Natural Resources' Solid Waste Management Program (SWMP) received a permit modification request on behalf of Bridgeton Landfill Authority for the Bridgeton Sanitary Landfill, Permit Number 118912. The proposed modification was submitted for the purpose of obtaining a vertical expansion, improving the leachate collection force main system, approval of a gas collection system, and other modifications to the landfill design.

The SWMP hereby approves the following parts of the addendum subject to the conditions stated herein:

1. The leachate header and force main improvements;

2. The gas control plan and associated pipe layout as an alternate to the previously approved gas recovery and processing facility;

3. The storm water control plan;

4. The vertical expansion and associated final contours; and

5. The closure and post-closure plan and cost estimates of $2,171,487 for closure and $9,552,900 for post-closure care.

Raising the head levels in the leachate risers is specifically not approved.

This approval is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law; nor should it be construed as a waiver for other regulatory requirements. This addendum is not to be construed as compliance with any existing local ordinances or zoning requirements; nor does it supersede any local permitting and/or zoning requirements.

The permit holder must ensure that the design and operational changes are properly implemented.

Conditions

The following conditions are an integral part of the permit addendum. Compliance with these conditions shall, in part, determine compliance with Permit Number 118912:

1. The permittee must submit either a revised or a new financial assurance instrument in the amount of $11,724,387 specifying the amounts designated for closure and post-closure.

2. The permittee must not, under any circumstances, allow the leachate levels to rise above the currently approved levels.

3. It does not appear that this modification will affect the radiologically contaminated areas. However, monitoring well D-14 may be affected. Please contact the department's Hazardous Waste Program, Superfund Section, prior to abandoning this or any other well which may be affected by the expansion activities.

Document

The following document is hereby incorporated into Permit Number 118912:

Facility Upgrade and Permit Modification for the Laidlaw Waste System (Bridgeton), Inc., MDNR Permit Number 118912, Saint Louis County Permit Number 419, Saint Louis County, Missouri, Volumes I and II; prepared by Midwest Environmental Consultants, P.C., 2014 Williams Street, Jefferson City, Missouri 65109.

The department reserves the right to revoke, suspend, or modify this addendum and/or Permit Number 118912 after due notice, if the permit holder fails to maintain the facility in compliance with the Missouri Solid Waste Management Law and regulations, the terms and conditions of the permit, and the approved engineering plans and specifications.

Should you have any questions, please contact Mr. Steven Wyatt of the SWMP at (573) 751-5401.

Sincerely,

DEPARTMENT OF NATURAL RESOURCES

Stephen Mahfood
Director

SM:swb

c: Matt Kingsley, P.E., General Manager, Bridgeton Landfill Authority
Lee D. Tharp, P.E., Midwest Environmental Consultants
Mr. Brad Bomanz, St. Louis County Department of Health
Mr. Charles Wildt, St. Louis County Department of Health
Mr. Ed Galbraith, Chief, Enforcement Section, SWMP, MDNR
Mr. David Erickson, Geologist, Division of Geology and Land Survey, MDNR
St. Louis Regional Office, MDNR

APPENDIX B

Post-Closure Plan for Closed Demolition Landfill

POST CLOSURE CARE PLAN

BRIDGETON LANDFILL DEMOLITION LANDFILL

BRIDGETON, ST. LOUIS COUNTY, MISSOURI

Prepared for:

Bridgeton Landfill

March 2006

Prepared by

Feezor Engineering, Inc.
406 East Walnut
Chatham, Illinois 62629

Project # BT-004

CONTENTS

LIST OF APPENDICES AND SUB-APPENDICES 1

1 INTRODUCTION 2

1.1 OVERVIEW OF PROJECT 2
1.2 PURPOSE AND SCOPE 2
1.3 REGULATORY REQUIREMENTS 2
1.4 CONTACT INFORMATION 3

2 POST CLOSURE CARE PLAN 5

2.1 OVERVIEW 5
2.2 MAINTENANCE AND INSPECTION 5
2.2.1 Inspection 5
2.2.2 Cover 6
2.2.3 Vegetation 6
2.3 GAS SYSTEM 7
2.4 GROUND-WATER MONITORING 7
2.5 LEACHATE MANAGEMENT AND MONITORING 7
2.6 DOCUMENTATION 7

3 CERTIFICATION 9

APPENDICES AND SUB APPENDICES

WLLFOIA4312 - 001 - 0053085

APPENDICES

A. Site Facility Map
B. September 1, 2005 Letter from Missouri Department of Natural Resouces

WLLFOIA4312 - 001 - 0053086

1 INTRODUCTION

1.1 Overview of Project

The documentation provided herein documents the Post Closure Care Activities of the approximately 15.84-acre Demolition Landfill at the Bridgeton Landfill in Bridgeton, Missouri. The Bridgeton Landfill is a currently permitted landfill with the Missouri Department of Natural Resources (Permit Number 218912), which is comprised of three separate disposal areas. The Active Sanitary Landfill has ceased accepting Municipal Solid Waste (MSW). The Inactive Landfill also accepted MSW, and ceased accepting materials in 1975. The Demolition Landfill accepted only demolition debris, and ceased accepting waste in 1995. The Demolition Landfill was closed with 2 feet of protective soils and vegetated. See Figure 1 for locations of the three-landfill areas.

All three landfill areas are part of the United States Environmental Protection Agency - Comprehensive Environmental Response, Compensation, and Liability Act (USEPA – CERCLA) West Lake Landfill Operable Unit 2. On January 31, 2006, the USEPA issued comments regarding the Memorandum of Remedial Action Objectives (RAO). As part of these comments, the USEPA stated that the Demolition Landfill should have an updated Post Closure Care Plan.

1.2 Purpose and Scope

The purpose of this report is to provide a Post Closure Care Plan for the Demolition Landfill. This plan is to be used by the site operator to schedule inspections and provide ongoing maintenance of the final cover.

1.3 Regulatory Requirements

The site was closed before the adoption of the Demolition Landfill regulations, 10 Code of State Regulations (CSR) 80-4.010, and the Missouri Demolition Landfill regulations are therefore inapplicable. However, 10 CSR 80-4.010 (20) 2 has been used for the development of this Post Closure Plan.

WLLFOIA4312 - 001 - 0053087

In accordance with 10 CSR 80-4.010 (20) 2 A, the existence of a demolition landfill must be recorded with the recorder of deeds in the county where the demolition landfill is located. This must include a survey and plat meeting the requirements of the current Minimum Standards of Property Boundary Survey 10 CSR 30-2.010 and detailed description of the demolition landfill must be prepared by a Professional Land Surveyor.

In addition, the operator must execute an easement with the MDNR which allows for access from the MDNR or their contractors. This will allow the MDNR to complete work specified in this Post Closure Care plan, to maintain the demolition landfill, or to take remedial action during the Post Closure Care period if needed.

In a letter dated September 1, 2005 (copy attached), MDNR's Engineering Section notes that final closure of the Demolition Landfill will be approved upon a department site inspection to verify that a thick, hardy stand of vegetation exists on the landfill, recording the existence of the landfill with the county Recorder of Deeds, and submittal of a survey plat and an easement form for the department's review. The September 1, 2005 letter further states that since there are other permitted facilities at the site (i.e., the Active Sanitary Landfill), it is acceptable to complete one survey and one easement form for the entire set of landfills. One survey and one easement form are planned for submittal, to be made concurrently with submittal of final closure documentation for the Active Sanitary Landfill. Final closure documentation for the Active Landfill is scheduled to be submitted by December 2006. It is therefore anticipated that the survey and easement form for the Demoliton Landfill will be submitted by December 2006.

1.4 Contact Information

The Project Manager for the Bridgeton Landfill, L.L.C. is listed below:

Mr. Allen Steinkamp
Environmental Manager
13570 St. Charles Rock Road
Bridgeton, Missouri 63044
Phone: (314) 739-1919
Fax (314) 739-2588
Email: Allen.Steinkamp@awin.com

Feezor Engineering, Inc prepared the Demolition Landfill Post Closure Care Plan. The Project Manager for Feezor Engineering, Inc. is listed below:

Mr. Daniel Feezor, P.E.
Feezor Engineering, Inc.
406 East Walnut

WLLFOIA4312 - 001 - 0053088

Chatham, Illinois 62629
Phone: (217) 753-3988
Fax (217) 753-3989
Email: Dfeezor@Feezorengineering.com

WLLFOIA4312 - 001 - 0053089

2 POST CLOSURE CARE PLAN

2.1 Overview

The operator is responsible for maintaining and monitoring the site for a 15-year period. In accordance with the RAO, a Post-Closure Care Plan must be submitted to the Missouri Department of Natural Resources (MDNR) describing how the post-closure care will be conducted. Activities necessary for post-closure care at the subject facility are detailed below.

2.2 Maintenance and Inspection

A maintenance program will ensure proper functioning of all systems that remain on the facility after closure. The maintenance program will include the following:

2.2.1 Inspection

A walking, visual inspection of the entire site will be conducted semi-annually with a written record of the inspection made and preserved. The inspector should assess the condition and need for repair of final cover, vegetation, fencing, monitoring points, drainage structures, etc.

In general, the following guidelines will be followed when assessing the need for maintenance actions:

- All rills, gullies, and crevices six inches or deeper in the final cover will be filled. Areas identified by the operator as particularly susceptible to erosion will be recontoured;
- All reworked surfaces and areas with failed or eroded vegetation in excess of 100 square feet will be revegetated in accordance with the approved closure plan;
- All holes and depressions created by settling will be filled and recontoured so as to prevent standing water;

WLLFOIA4312 - 001 - 0053090

- All eroded and scoured drainage channels will be repaired if necessary.

2.2.2 Cover

In a letter dated September 1, 2005, MDNR's Engineering Section confirmed that a two-foot cap thickness is acceptable for the Demolition Landfill, and that the final cover currently is in good condition.

Because of the waste composition, differential settlement is not anticipated. Erosion or ponding may cause the need for cover repairs. Any areas where ponding occurs or erosion cuts appear must be promptly repaired in order to maintain the quality of the final cover as described in the closure plan. Based upon experience with landfills of this size and location, an average maintenance rate of 1% of the site per year is assumed. A borrow area must be maintained for such activities.

Loams of the USDA soils classification system or Unified Soils Classification System types GM, GC, SM, SC, ML and CL are all considered suitable protective soils. However, any of these soils that are used should be evaluated by an agronomist or other appropriate expert prior to seeding to determine what, if any, soil amendments may be necessary for proper vegetative growth. The bottom 12 inches of the layer should be compacted slightly as necessary to resist erosion. The top 12 inches should not be compacted and should be the best on-site readily available soil for supporting vegetation. Verification of the minimum thickness of the protective layer will be achieved on a maximum 200-foot grid by depth checks or by surveying the topography before and after cover placement.

2.2.3 Vegetation

Areas repaired will require re-establishment of the vegetative cover. Further, any barren areas noted during inspections will be repaired. It assumed that an average of 2% of the site would require annual repair during the post-closure care period. In addition, the site will be mowed at least once per year.

The final cover at the Demolition Lanfill is established, but could require establishment of a vegetative cover growth within any potential repair areas. Seed will typically be incorporated into the upper surface of the protective soil layer using a disk, harrow or by using hydroseeding techniques. The mixture selected must be amenable to the soil quality/thickness, slopes and moisture/climatological conditions that exist without the need for continued maintenance and with minimal potential for root penetration into the compacted final clay cover. It shall also be a diverse mix of native and introduced species that is tolerant of the soils and consistent with the "open space" post-closure land use. Such a mixture could include Kentucky Bluegrass, Perennial Ryegrass, Crown

WLLFOIA4312 - 001 - 0053091

Vetch and White Clover. Fertilizer, lime and mulch should be used at rates necessary to establish proper growth of the seed.

2.3 Gas System

Because the landfill contains only demolition waste, this section is not applicable.

2.4 Ground-Water Monitoring

Because the landfill contains only demolition waste, there is no groundwater monitoring network.

2.5 Leachate Management and Monitoring

Because the landfill is not equipped with a leachate collection system, this section is not applicable.

2.6 Documentation

Current regulations require that a plat of the completed site be filed with the appropriate St. Louis County land recording authority. It will be necessary to contract this work to a Missouri Registered Land Surveyor. This plat will include:

- The name of the property owner,
- A detailed description of the property,
- The general types and location of the solid waste, and an estimated depth of fill of the waste, and
- The locations of any monitoring device.

The operator will execute an easement with the MDNR which allows for access from the MDNR or their contractors. This easement will provide access to the MDNR to complete work specified in this Post Closure Care plan, to maintain the demolition landfill, or to take remedial action during the Post Closure Care period if needed.

The September 1, 2005 MDNR letter states that since there are other permitted facilities at the site (i.e., the Active Sanitary Landfill), it is acceptable to complete one survey and one easement form for the entire set of landfills. One survey and one easement form are planned for submittal, to be made concurrently with submittal of final closure

WLLFOIA4312 - 001 - 0053092

documentation for the Active Sanitary Landfill. Final closure documentation for the Active Landfill is scheduled to be submitted by December 2006. It is therefore anticipated that the survey and easement form for the Demoliton Landfill will be submitted by December 2006.

In addition, records of inspections will be maintained throughout the Post Closure Care Period.

WLLFOIA4312 - 001 - 0053093

3 CERTIFICATION

I, Daniel R. Feezor, P.E., do hereby certify to my best knowledge and belief that the Bridgeton Demolition Landfil Post Closure Care Plan was developed consistent with the applicable regulations, and current industry practices.

Daniel R. Feezor, P.E.

STATE OF MISSOURI
DANIEL
RICHARD FEEZOR
NUMBER
E-30292
REGISTERED PROFESSIONAL ENGINEER

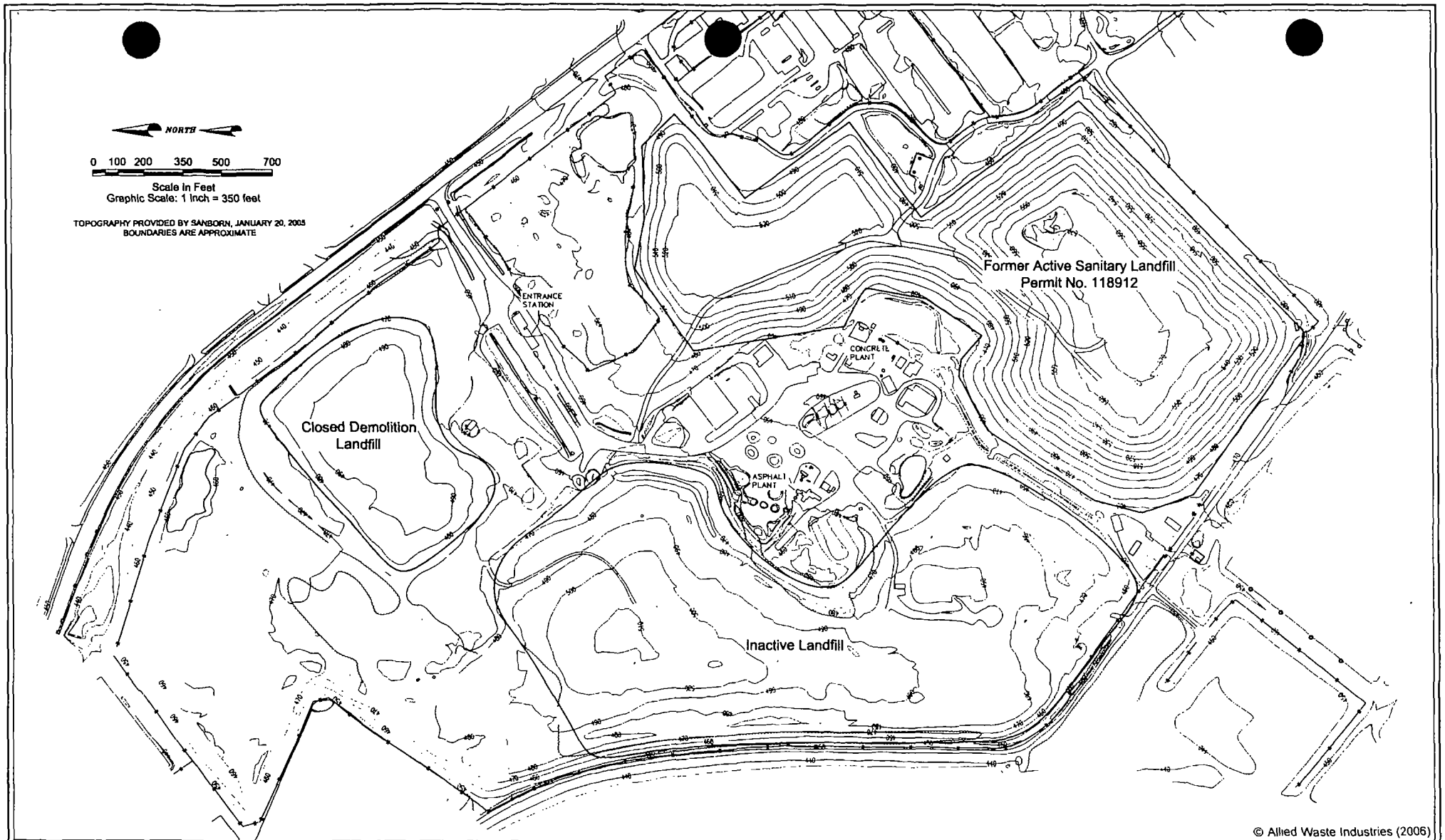
3-30-06

Missouri P.E. Number 030292

WLLFOIA4312 - 001 - 0053094

APPENDIX A

SITE FACILITY MAP



© Allied Waste Industries (2006)

HERST & ASSOCIATES, INC.
4530 South Highway 94
North Outer Road
St Charles Missouri 63304
Phone (636) 939-9111
Fax (636) 939-9757

West Lake Landfill OU-2
Bridgeton, Missouri

Figure 1
Areas Where Landfill Activities Have Been Conducted

APPENDIX B

SEPTEMBER 1, 2005 LETTER FROM MISSOURI DEPARTMENT OF NATURAL RESOUCES

STATE OF MISSOURI

Matt Blunt, Governor • Doyle Childers, Director

DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov

SEP 1 2005

CERTIFIED MAIL # 7004 1160 0000 8169 6911
RETURN RECEIPT REQUESTED

RECEIVED
SEP 06 2005
BY:

Mr. Casey Powers
Bridgeton Landfill Authority
12976 St. Charles Rock Road
Bridgeton, MO 63044

RE: Bridgeton Landfill, L.L.C., Permit Number 218912, St. Louis County

Dear Mr. Powers:

On December 7, 2004, the Missouri Department of Natural Resources' Solid Waste Management Program (SWMP) received a letter from Allen Steinkamp of Bridgeton Landfill Authority concerning the closure of the Bridgeton Demolition Landfill. Enclosed with his letter was closure documentation dated July 6, 1999 prepared by Herst & Associates, Inc.

In subsequent telephone conversations with Ms. Charlene Fitch of my staff following submittal of this information, Mr. Steinkamp discussed the demolition landfill capping requirements in the Missouri Solid Waste Management Regulations. The regulations changed in 1988 to require demolition landfills to increase their design cap thickness to three feet; though the department did not systematically require owners to update their closure plans. According to inspection reports, the demolition landfill ceased accepting waste in June, 1995. During the telephone conversations you asked whether the department would accept the two foot cap thickness as required in the approved closure plan, and as documented by Herst and Associates. You submitted the closure documentation for a determination since the facility budget would be impacted by our decision.

After reviewing your submittal the department has determined that the two foot cap thickness is acceptable. This decision is based on the fact that the approved closure plan calls for a two foot thick cap. Additionally, the final cover is in good condition and we believe it would be unwise to destroy the existing cap in order to add an additional foot of soil cover.

This is not final closure approval for the Bridgeton Demolition Landfill. It is simply an acknowledgement that two feet of soil cover is acceptable. Final closure of the Bridgeton Demolition landfill will not be approved until the following items are addressed:

1. The department will conduct a site inspection and verify that a thick hardy stand of vegetation exists on the landfill. Please let the department know when you would like to schedule a closure inspection.

Recycled Paper

10 CSR 80-4.010 (20)(C)(2.B)

2. Section (16)(C)2 of the regulations also requires the existence of the landfill to be recorded with the county Recorder of Deeds. You must submit a survey plat and the completed form titled "Easement, Notice, and Covenant Running With Land" (copy enclosed) for the department's review prior to having them recorded. Since there are other permitted facilities at the site, if you wish to complete one survey and one easement form for the entire set of landfills at the Bridgeton site you may do so. Please notify the department's SWMP which direction you wish to take.

We appreciate your continued efforts toward environmentally sound solid waste management practices. If you have any questions or comments, please contact Ms. Charlene Fitch at (573) 751-5401 or at P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Jim Bell

Jim Bell
Chief, Engineering Section

JB:cfe

c: Mr. Allen Steinkamp, Bridgeton Landfill Authority
Ms. Sue Taylor, St. Louis County Department of Health
Ms. Beth Marsala Chief, Enforcement Section, SWMP
St. Louis Regional Office

APPENDIX C

Cost Estimate Details

For purposes of facilitating comparisons, the following cost assumptions and discussion were modified from the West Lake OU-1 Feasibility Study, revised March 2005. All costs are shown in March 2006 dollars. Capping costs are based on costs presented in the March 2005 OU-1 Feasibility Study, updated to March 2006 dollars, and include a 25 percent costing and scoping contingency.

Present net worth estimates assume a 7% discount rate.

A 25% allowance was added to clay soil volume calculations to account for compaction during placement. A 33% compaction allowance was added to topsoil to account for compaction. These are consistent with assumptions utilized in the OU-1 FS.

5 Year Review Cost Estimate - First Review
Alternative 1 - No Action

Description	Quantity	Units	Unit Rate	Estimated Cost
Estimated Costs:				
Labor and Expenses	1	Lump Sum	$20,000	$20,000
Subtotal				$20,000
Regulatory Oversight	1	Lump Sum	$5,000	$5,000
Estimated Costs Initial 5-year Review - Total				$25,000

5 Year Review Cost Estimate - Subsequent to Initial Review
Alternative 1 - No Action

Description	Quantity	Units	Unit Rate	Estimated Cost
Estimated Costs:				
Labor and Expenses	1	Lump Sum	$15,000	$15,000
Subtotal				$15,000
Regulatory Oversight	1	Lump Sum	$5,000	$5,000
Estimated Costs Subsequent 5-year Reviews - Total				$20,000

Present Worth Cost Estimate
Alternative 1 - No Action

Year	n	P/F (i = 7%)	5-Year Review Costs: Initial 5-Year Review	5-Year Review Costs: Subsequent 5-Year Reviews	Total Costs	Present Worth of Costs	Cumulative Present Worth
2006	0	1.00000			$0	$0	$0
2007	1	0.93458			$0	$0	$0
2008	2	0.87344			$0	$0	$0
2009	3	0.81630			$0	$0	$0
2010	4	0.76290			$0	$0	$0
2011	5	0.71299	$25,000		$25,000	$17,825	$17,825
2012	6	0.66634			$0	$0	$17,825
2013	7	0.62275			$0	$0	$17,825
2014	8	0.58201			$0	$0	$17,825
2015	9	0.54393			$0	$0	$17,825
2016	10	0.50835		$20,000	$20,000	$10,167	$27,992
2017	11	0.47509			$0	$0	$27,992
2018	12	0.44401			$0	$0	$27,992
2019	13	0.41496			$0	$0	$27,992
2020	14	0.38782			$0	$0	$27,992
2021	15	0.36245		$20,000	$20,000	$7,249	$35,241
2022	16	0.33873			$0	$0	$35,241
2023	17	0.31657			$0	$0	$35,241
2024	18	0.29586			$0	$0	$35,241
2025	19	0.27651			$0	$0	$35,241
2026	20	0.25842		$20,000	$20,000	$5,168	$40,409
2027	21	0.24151			$0	$0	$40,409
2028	22	0.22571			$0	$0	$40,409
2029	23	0.21095			$0	$0	$40,409
2030	24	0.19715			$0	$0	$40,409
2031	25	0.18425		$20,000	$20,000	$3,685	$44,094
2032	26	0.17220			$0	$0	$44,094
2033	27	0.16093			$0	$0	$44,094
2034	28	0.15040			$0	$0	$44,094
2035	29	0.14056			$0	$0	$44,094
2036	30	0.13137		$20,000	$20,000	$2,627	$46,721
	Total Estimated Costs		$25,000	$100,000			$46,721

Capital Cost Estimate
Alternative 2 - Missouri-prescribed Cover with Long-Term Monitoring and Institutional Controls
(Cover Installation)

Description	Quantity	Units	Unit Rate	Estimated Cost
Estimated Capital Costs:				
Work Plan	1	each	$50,000	$50,000
Surveying (site layout)	15	day	$1,023	$15,345
Secure access / easements	1	lump sum	$10,000	$10,000
Inactive Landfill Perimeter Silt Fence	6,600	feet	$2.05	$13,530
Geotechnical testing of borrow materials	1	each	$20,459	$20,459
Perimeter drainage				
Drainage channels	6,600	linear feet	$4.51	$29,766
Place cover over Inactive Landfill area				
Clearing / grubbing / preparation	47.5	acre	$5,933	$281,818
Deliver, place, and compact 10^{-5} permeability soil over Region 3-1	14,520	cubic yard	$18.55	$269,346
Deliver, place, and compact 10^{-5} permeability soil over Region 3-2	5,091	cubic yard	$18.55	$94,438
Deliver, place, and compact 10^{-5} permeability soil over Region 3-3	6,370	cubic yard	$18.55	$118,164
Deliver, place, and compact 10^{-5} permeability soil over Region 3-4	484	cubic yard	$18.55	$8,978
Deliver and place 1 foot vegetative growth layer over Inactive Landfill area (approx 47.5 acres)	101,922	cubic yard	$25.03	$2,551,108
Fertilize / seeding / mulching	47.5	acre	$1,534	$72,865
Survey control	130	day	$1,023	$132,990
Materials testing equipment during construction	8	month	$2,046	$16,368
Monitoring during construction				
Continuous monitoring / recording of air flow	1	lump sum	$20,459	$20,459
Meterological	8	month	$2,046	$16,368
Health and safety monitoring	8	month	$7,388	$59,104
Miscellaneous site work	1	lump sum	$50,000	$50,000
Surveying ("record drawings")	11	day	$1,023	$11,253
Construction completion report	1	lump sum	$50,000	$50,000
Health and safety surcharge for CERCLA site contractor	10	%	$1,025,627	$102,563
Estimated Construction Costs - Subtotal				**$3,994,921**
Contractor Markup, Mob/demob, Insurance	10	%		$399,492
Engineering, Permitting, and Construction Management	20	%		$798,984
Regulatory Oversight	2.5	%		$99,873
Estimated Project Capital Costs - Subtotal				**$5,293,270**
Contingency	25	%		$1,323,317.46
Estimated Project Capital Costs - Total				**$6,616,587**

Capital Cost Estimate
Alternative 2 - Missouri-prescribed Cover with Long-Term Monitoring and Institutional Controls
(Monitoring System Construction & Additional Institutional Controls)

Description	Quantity	Units	Unit Rate	Estimated Cost
Estimated Capital Costs:				
Planning Documents	1	lump sum	$10,000	$10,000
Secure easements	1	lump sum	$1,000	$1,000
Install 13 new perimeter landfill gas monitoring wells	13	each	$1,200	$15,600
Labor to establish Institutional Controls	1	lump sum	$16,000	$16,000
Estimated Capital Costs - Subtotal				**$42,600**
Contingency	25	%		$10,650
Estimated Project Capital Costs - Total				**$53,250**

Operation and Maintenance Cost Estimate - Cover System
Alternative 2 - Missouri-prescribed Cover with Long-Term Monitoring and Institutional Controls

Description		Quantity	Units	Unit Rate	Estimated Cost
Estimated Annual Operation and Maintenance Costs:					
Annual inspection and report		1	each	$6,000	$6,000
Mowing (3 times per year)	3 x	47.5	acre	$40.92	$5,831
Estimated Annual Operation and Maintenance Costs - Subtotal					**$11,831**
Contingency		25	%		$2,958
Estimated Annual Operation and Maintenance Costs - Total					**$14,789**

Operation and Maintenance Cost Estimate - 5 Year Maintenance and Review
Alternative 2 - Missouri-prescribed Cover with Long-Term Monitoring and Institutional Controls

Description	Quantity	Units	Unit Rate	Estimated Cost
Estimated 5-Year Operation and Maintenance Costs:				
Cover Maintenance (1 acre, 1 foot thick)	1,613	cubic yard	$25.03	$40,373
Reseeding	1	acre	$2,046	$2,046
5-Year Review	1	each	$20,000	$20,000
Estimated 5-Year Operation and Maintenance Costs - Subtotal				**$62,419**
Contingency	25	%		$15,605
Estimated 5-Year Operation and Maintenance Costs - Total				**$78,024**

Operation and Maintenance Cost Estimate - Monitoring
Alternative 2 - Missouri-prescribed Cover with Long-Term Monitoring and Institutional Controls
(Groundwater and Landfill Gas Monitoring)

Description	Quantity	Units	Unit Rate	Estimated Cost
Estimated Annual Groundwater and Landfill Gas Monitoring Costs:				
Quarterly Monitoring and Reporting for 13 Perimeter Gas Monitoring Probes	4	event	$1,000	$4,000
Annual Collection of Samples from 6 Groundwater Monitoring Wells	1	event	$2,450	$2,450
Annual Analysis of Assessment Monitoring Parameters (includes 1 Field Blank, 1 Field Duplicate, & 1 Trip Blank (VOCs only) per event)				
Volatile Organic Compounds (Method 8260B)	8	each	$75	$600
Total Petroleum Hydrocarbons	8	each	$110	$880
Data Validation	1	event	$2,000	$2,000
Reporting	1	event	$2,500	$2,500
Estimated Annual Groundwater and Landfill Gas Monitoring Costs - Subtotal				**$12,430.00**
Contingency	25	%		$3,107.50
Estimated Annual Groundwater and Landfill Gas Monitoring Costs - Total				**$15,538**

Present Worth Cost Estimate
Alternative 2 - Missouri-prescribed Cover with Long-Term Monitoring and Institutional Controls

Year	n	P/F (i = 7%)	Capital Costs			Annual Operation and Maintenance Costs				Total Costs	Present Worth of Costs	Cumulative Present Worth
			Cover Construction	Monitoring & Institutional Controls	Subtotal Capital Costs	Cover Improvements	Monitoring	5 Year Main + Review	Subtotal O&M Costs			
2006	0	1.00000	$6,616,587	$53,250	$6,669,837					$6,669,837	$6,669,837	$6,669,837
2007	1	0.93458			$0	$14,789	$15,538		$30,326	$30,326	$28,342	$6,698,180
2008	2	0.87344			$0	$14,789	$15,538		$30,326	$30,326	$26,488	$6,724,668
2009	3	0.81630			$0	$14,789	$15,538		$30,326	$30,326	$24,755	$6,749,423
2010	4	0.76290			$0	$14,789	$15,538		$30,326	$30,326	$23,136	$6,772,559
2011	5	0.71299			$0	$14,789	$15,538	$78,024	$108,351	$108,351	$77,252	$6,849,812
2012	6	0.66634			$0	$14,789	$15,538		$30,326	$30,326	$20,208	$6,870,019
2013	7	0.62275			$0	$14,789	$15,538		$30,326	$30,326	$18,886	$6,888,905
2014	8	0.58201			$0	$14,789	$15,538		$30,326	$30,326	$17,650	$6,906,555
2015	9	0.54393			$0	$14,789	$15,538		$30,326	$30,326	$16,496	$6,923,051
2016	10	0.50835			$0	$14,789	$15,538	$78,024	$108,351	$108,351	$55,080	$6,978,131
2017	11	0.47509			$0	$14,789	$15,538		$30,326	$30,326	$14,408	$6,992,539
2018	12	0.44401			$0	$14,789	$15,538		$30,326	$30,326	$13,465	$7,006,004
2019	13	0.41496			$0	$14,789	$15,538		$30,326	$30,326	$12,584	$7,018,588
2020	14	0.38782			$0	$14,789	$15,538		$30,326	$30,326	$11,761	$7,030,349
2021	15	0.36245			$0	$14,789	$15,538	$78,024	$108,351	$108,351	$39,271	$7,069,621
2022	16	0.33873			$0	$14,789	$15,538		$30,326	$30,326	$10,273	$7,079,893
2023	17	0.31657			$0	$14,789	$15,538		$30,326	$30,326	$9,601	$7,089,494
2024	18	0.29586			$0	$14,789	$15,538		$30,326	$30,326	$8,972	$7,098,466
2025	19	0.27651			$0	$14,789	$15,538		$30,326	$30,326	$8,385	$7,106,852
2026	20	0.25842			$0	$14,789	$15,538	$78,024	$108,351	$108,351	$28,000	$7,134,852
2027	21	0.24151			$0	$14,789	$15,538		$30,326	$30,326	$7,324	$7,142,176
2028	22	0.22571			$0	$14,789	$15,538		$30,326	$30,326	$6,845	$7,149,021
2029	23	0.21095			$0	$14,789	$15,538		$30,326	$30,326	$6,397	$7,155,418
2030	24	0.19715			$0	$14,789	$15,538		$30,326	$30,326	$5,979	$7,161,397
2031	25	0.18425			$0	$14,789	$15,538	$78,024	$108,351	$108,351	$19,964	$7,181,360
2032	26	0.17220			$0	$14,789	$15,538		$30,326	$30,326	$5,222	$7,186,582
2033	27	0.16093			$0	$14,789	$15,538		$30,326	$30,326	$4,880	$7,191,463
2034	28	0.15040			$0	$14,789	$15,538		$30,326	$30,326	$4,561	$7,196,024
2035	29	0.14056			$0	$14,789	$15,538		$30,326	$30,326	$4,263	$7,200,287
2036	30	0.13137			$0	$14,789	$15,538	$78,024	$108,351	$108,351	$14,234	$7,214,521
	Total Estimated Costs		$6,616,587	$53,250	$6,669,837				**Total Estimated Present Worth:**			**$7,214,521**