EPA/ROD/R10-00/125
2000

EPA Superfund
Record of Decision:

HIDDEN VALLEY LANDFILL (THUN FIELD)
EPA ID: WAD980511539
OU 01
PIERCE COUNTY, WA
09/28/2000

CLEANUP ACTION PLAN

HIDDEN VALLEY LANDFILL

PIERCE COUNTY, WASHINGTON

September, 2000

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1. INTRODUCTION

This Cleanup Action Plan (CAP) specifies cleanup standards and identifies the cleanup action to be implemented at the Hidden Valley Landfill (also known as the "Site"). Hidden Valley Landfill is listed on the National Priorities List (NPL) as a site that warrants action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The lead agency designated to oversee cleanup of the site is the state of Washington, Department of Ecology (Ecology). As required by the Washington Model Toxics Control Act (MTCA, RCW 70.105D), this CAP describes the alternatives for remediation at the site and selects the proposed remedial action alternative for the site. All work to be performed to satisfy this CAP shall be performed under a Consent Decree.

2. SITE DESCRIPTION

Hidden Valley Landfill is located in central Pierce County at 17925 South Meridian Street, Puyallup, Washington (Figure 1). The site lies in the north half of the northwest quarter of Section 34, Township 19 North, Range 4 East, of the Willamette Meridian. The landfill property is approximately 92 acres in size. The landfill includes approximately 56 acres of closed, unlined fill, a closed 30-acre lined cell, a leachate pre-treatment facility, and a gas-to-energy facility (Figure 2). Hidden Valley Landfill began operation in the mid-1960s and accepted municipal solid waste until December 31, 1998. Originally the site was leased by Pierce County and operated by the Pierce County Department of Public Works (Public Works). Land Recovery, Inc. (LRI), a privately owned solid waste disposal company, assumed operation of the landfill in 1977 and has operated it since that time. Waste disposed at the landfill has included municipal solid waste, demolition wastes, and commercial waste. Prior to 1985, when applicable regulations changed, small quantities of bulk liquids, sludges, and larger volumes of industrial waste were reported to have been accepted at the landfill.

The lined cell, referred to as the East Lined Area, was constructed in two stages in 1991 and 1993. The 1991 construction consisted of the 13-acre bottom liner over native soils and the lower portion of the side slope liner over refuse. The 1993 construction consisted of the remaining portion of the side slope liner. Placement of refuse in the East Lined Area (over bottom liner) began in the spring of 1992. Leachate is collected from the East Lined Area and pretreated on-site prior to discharge to the Pierce County sewer system.

Closure of the unlined portion of the landfill occurred in phases during the summer seasons of 1989 (North Closure - 13 acres), 1992 (Southwest Closure – 26 acres) and 1993 (remaining closure of unlined area – 17 acres). Closure of the East Lined Area began in the summer of 1998, with approximately 11 acres receiving final closure. The remaining 22 acres of the East Lined Area underwent final closure in 1999 and 2000. Closure of the unlined landfill was in accordance with Washington Administrative Code (WAC) Chapter 173-304, Minimum Functional Standards for Solid Waste Handling (MFS). Closure of the East Lined Area is in accordance with WAC 173-351, Criteria for Municipal Solid Waste Landfills. Closure activities included the installation of an engineered geomembrane cap (unlined area consistent with WAC 173-304) or a composite geomembrane cap (lined area consistent with WAC 173-351), a landfill gas recovery system, and storm water controls.

3. PROJECT HISTORY

The results of environmental studies conducted from 1981 through 1985 were used by the U.S. Environmental Protection Agency (EPA) to prepare a preliminary assessment and a hazard ranking scoring (HRS) of the site in 1985, As a result of the HRS, Hidden Valley Landfill was placed on the Nation Priorities List (NPL) in April 1989.

The site was regulated by the Tacoma-Pierce County Health Department (Health Department) through annual operating permits. In addition, in September 1986, LRI and the Health Department executed a memorandum of agreement (MOA) governing interim and final closure of the active portions of the landfill, construction of a gas collection and migration control system, evaluation of leachate collection, and further site development consistent with the MFS.

In 1987, LRI and Ecology executed Consent Order No. DE 86-S173 (Consent Order) under authority of the State of Washington Water Pollution Prevention Act, Chapter 90.48, Revised Code of Washington (RCW); the Hazardous Waste Regulation Act, Chapter 70.105 RCW; the Washington Clean Air Act, Chapter 70.94 RCW; and Subchapter IV of the Resource Conservation and Recovery Act, 42 USC 6901-6991. The Consent Order required LRI to conduct a remedial investigation and feasibility study, and to comply with the Health Department MOA provisions regarding operation and closure of the existing landfill footprint.

The Consent Order was amended by agreement of the parties on September 21, 1988. Under the amendment, the schedule for submission of several documents was changed and sampling requirements were modified. When the Consent Decree implementing this CAP becomes effective, the 1987 Consent Order will be superseded.

A draft remedial investigation (RI) report was submitted to Ecology on September 15, 1990. Agency comments were received and the RI report was revised and resubmitted on February 1, 1991. Following receipt of a second set of agency comments, the R1 report was revised again and submitted as final on March 14, 1992. A. baseline risk assessment (RA) was submitted to Ecology February 15, 1991. The RA evaluated existing and potential (future) exposure scenarios for soils, surface water, landfill gas, and groundwater. The feasibility study (FS) report was submitted to Ecology in draft on February 1, 1991. Following receipt of comments, the FS report was revised and submitted as final on May 26, 1992.

At the direction of Ecology, the following three technical memoranda were prepared to supplement information presented in the FS report; *Technical Memorandum No. 1, Capture Zone Analysis* (September 13, 1991), *Technical Memorandum No. 2, Treatment System Requirements* (June 27, 1991), and *Technical Memorandum No. 3, Infiltration of Treated Water* (July 3, 1991). In addition, a *Hydrogeologic Report Addendum* (December 16, 1998) was prepared at the direction of Ecology. The report addendum evaluated off-site water quality, time trends, and statistical results for both wet (October through April) and dry (May through September) seasons.

A water supply well canvass (survey of potential users) was conducted by the Tacoma-Pierce County Health Department in 1985. A second canvass was performed by LRI at the direction of Ecology in 1999 within an area of approximately ½-mile upgradient and 1-mile downgradient of the landfill. The purpose of the surveys was to determine whether any wells used for domestic purposes were affected by the landfill. The surveys confirmed that homes in the vicinity of the landfill receive water from water purveyors. Several wells were previously known to exist within the survey area, and are routinely monitored by the Health Department as discussed in Section 4. No previously unidentified supply wells were identified within the survey area.

Environmental monitoring has continued at the site since the RI was submitted. Groundwater monitoring is conducted on a quarterly schedule and landfill gas monitoring is conducted monthly. The landfill is now closed and not accepting waste. A geomembrane cap has been constructed over the waste. The gas collection system was constructed in the late 1980s and has been in continuous operation since that time. A leachate collection system was installed in the lined area and collected leachate is pretreated and discharged to the county sewage treatment facility.

4. SITE CHARACTERIZATION

Hidden Valley Landfill is located in central Pierce County within the Clover/Chambers Creek (CCC) basin. The landfill lies within a Vashon age glacial melt-water channel that trends in an east-west direction. The landfill is underlain by successive layers of Vashon recessional outwash, Vashon till (lower till unit), Vashon advance outwash, Salmon Springs till and interglacial deposits, and Salmon Springs advance outwash (Figures 3 and 4). The outwash deposits consist of sand and gravel with some silt. The till deposits are composed of a mixture of compacted gravel, sand, and silt. The interglacial deposits consist of interbedded sandy gravels, gravely sands, and silty sands, with some wood debris and other organic material. Detailed descriptions of each unit, as well as boring logs/monitoring well details, are included in the *Hidden Valley Landfill Remedial Investigation Report*, (EMCON Northwest, 1992).

Two regional groundwater systems are present within the CCC basin; a relatively shallow system usually associated with Vashon outwash deposits (upper regional aquifer), and a deep system of several aquifers associated with older deposits (lower regional aquifer). Low permeability glacial till deposits and interglacial silt deposits form aquitards which separate the shallow and deep systems. The groundwater systems in the basin are recharged predominately from precipitation falling within the basin. Regional groundwater discharge is to Puget Sound and the Puyallup River.

Three aquifers have been identified beneath Hidden Valley Landfill: the shallow perched aquifer, the upper regional aquifer, and the lower regional aquifer (Figures 3 and 4). The uppermost saturated unit at the site is the shallow perched aquifer which generally occurs within the Vashon recessional outwash. It appears to be of limited extent. Northwest of the landfill, the recessional outwash is either not saturated, or saturated to only a few feet. The shallow perched aquifer is unconfined with a hydraulic conductivity estimated to be $\geq 10^{-1}$ cm/sec, and is not known to be a source of drinking water. The shallow perched aquifer and the upper regional aquifer are separated by an intermittent aquitard formed by the lower Vashon till. The Vashon till aquitard displays moderately low vertical hydraulic conductivity (generally 10^{-3} to 10^{-4} cm/sec) and is likely discontinuous. A downward vertical hydraulic gradient generally exists across the Vashon till aquitard in the area of the landfill. The upper regional aquifer occurs within the Vashon advance outwash, is partially confined beneath the Vashon till aquitard, and is continuous across the site. Hydraulic conductivity in the upper regional aquifer is estimated to be in the range of 10^{-2} cm/sec. The upper regional aquifer and the lower regional aquifer are separated by a thick section (55 to >130 feet) of low permeability deposits referred to as the Salmon Springs aquitard. The lower regional aquifer is present within the Salmon Springs advance outwash. The aquifer is confined and is of regional extent.

Depth to groundwater at the landfill is dependent on topography, Depth to water ranges from about 11 to 15 feet below ground surface (bgs) in winter and spring months, to about 25 feet bgs in late fall in the lower elevations (southern area) of the site, and generally ranges from approximately 120 to 145 feet bgs in the areas of higher elevations (northern area). Groundwater flow direction, water level gradients, and seasonal water level fluctuations in the shallow perched and upper regional aquifers are similar. Groundwater flow in both aquifers is to the northwest, with local components to the north and west. Horizontal hydraulic gradients in both aquifers are quite flat (less than 0.005 ft/ft) in the central part of the site and steepen (to about 0.01 ft/ft) northwest of the landfill. Groundwater flow in the deep regional groundwater system in the vicinity of Hidden Valley Landfill appears to be to the northeast toward the Puyallup River.

Water supply wells in the landfill vicinity obtain water primarily from the lower regional aquifer and, to a lesser extent, from the upper regional aquifer. The Health Department has performed quarterly water quality testing at five water supply wells (Firgrove No. 2 and No. 3, Thun Field Airport, Paul Bunyan Rifle Range, and Corliss Gravel Pit) located in the general vicinity of Hidden Valley Landfill. The groundwater samples are tested for general water quality parameters as well as dissolved iron, manganese, and zinc. No exceedances of federal primary drinking water standards (maximum contaminant levels [MCLs]) have been reported from these wells. The secondary MCL for iron is typically exceeded at the Thun Field well; however, recent testing by the Health Department indicates iron concentrations in the well may be the result of the well construction.

5. NATURE AND EXTENT OF CONTAMINATION

Investigations performed at Hidden Valley Landfill indicate that groundwater and landfill gas are affected by the release of hazardous substances from the landfill. Landfill gas containing methane and low levels of VOCs is present at the site, however, landfill gas is, and will continue to be managed by an active landfill gas recovery/destruction system. Operation of the system is pursuant to the Landfill Gas Management Plan. Groundwater quality in the shallow perched aquifer, and to a lesser extent the upper regional aquifer, has been affected by the landfill. No water quality impacts related to landfill operations have been identified in the lower regional aquifer. No surface water, other than seasonal ponded water, exists on or near the site.

Water quality data from the shallow perched and upper regional aquifers downgradient (northwest) of the landfill display elevated specific conductance and elevated concentrations of constituents typical of municipal solid waste landfills including ammonia, nitrate, dissolved iron and manganese, chloride, and sulfate, as well as low intermittent levels of VOCs including chlorobenzene, and 1,4-dichlorobenzene, and historical detections of benzene, 1,1-dichloroethane, and vinyl chloride.

Leaching is a primary contaminant release mechanism for hazardous substances from the landfill to groundwater. Leachate is a product of natural biodegradation, infiltration, and groundwater migrating through landfilled refuse. The infiltration of precipitation was probably the major source of leachate production prior to closure; however, data from site investigations indicate that seasonal groundwater inundation of waste may be a continuing release mechanism. When groundwater elevations in the shallow perched aquifer exceed approximately 430 feet (which typically occurs in the late winter and early spring), the base of the refuse becomes locally saturated and leachate is generated. Leachate generation from the seasonal contact of waste with groundwater is expected to decrease over time due to "flushing" of the refuse.

Groundwater quality data are largely in compliance with federal primary drinking water standards (MCLs); however, nitrate levels in the shallow perched, and to a lesser extent, the upper regional aquifer sporadically exceed the MCL of 10 milligrams per liter (mg/L). These exceedances occur concurrent with periods of groundwater recharge, with the highest nitrate concentrations reported when the water table has risen rapidly. Fluctuations in the nitrate-nitrogen/ammonia-nitrogen concentrations in the shallow perched aquifer are interpreted to result from changes in the oxidation/reduction potential of the groundwater. Nitrogen in the leachate is nearly all in the form of ammonia. During periods of aquifer recharge, the aquifer receives oxygenated water and the water table rises. Under these conditions, ammonia-nitrogen concentrations in the groundwater are oxidized to nitrate. During non-recharge periods, nitrogen concentrations are reduced to ammonia due to the anaerobic conditions in the vicinity of the landfill, and nitrate levels are typically very low to non-detect. Figures 5 and 6 depict the approximate distribution of nitrate in the shallow perched aquifer for the first and second quarters of 2000. As shown in Figure 6, second quarter 2000 data indicates that there were no exceedances of the nitrate MCL downgradient of the landfill.

Several methods were used to evaluate water quality at and near the landfill. Statistical analyses were performed using water quality data collected after March 1993, for all monitoring wells sampled over this period (17 Monitoring wells). March 1993 was selected as a starting point for evaluation because 1993 was the first full calendar year following complete closure of the unlined portion of the landfill. Analytical data were evaluated for dissolved iron and manganese, ammonia, nitrate, chloride, sulfate, alkalinity, total dissolved solids (TDS), total organic carbon (TOC), and volatile organic compounds (VOCs). Data sets from the shallow perched and upper regional aquifers were evaluated for wet (October through April) and dry (May through September) seasons. The 95 percent upper confidence limit on the means (UCL95) were compared to National Primary and Secondary Drinking Water Regulations standards established by EPA, and MTCA Method B cleanup levels established by Ecology. The UCL95 is a concentration established with 95 percent confidence as an upper bound on the true mean concentration. MTCA Method B and national primary standards are promulgated for the protection of human health, and national secondary standards are promulgated for the protection of aesthetic characteristics of drinking water. Cleanup standards for the site are discussed in Section 6 of this CAP.

Nitrate was the only parameter with a UCL95 that exceeded a primary MCL. In the shallow perched aquifer, UCL95 values exceeded the MCL of 10 mg/L at three wells (14S, 17S, and 18 S) during both the wet and dry seasons, and at two wells (11S, and 13S) during the wet season only. In the upper regional aquifer, UCL95 values exceeded the primary standard for nitrate at wells 11D, and 18D in the wet season only (the wet season UCL95 for well 18D is the result of a single detection of 20 mg/L, with all other concentrations (10 values) below 0.3 mg/L). UCL95s for 1,4,-dichlorobenzene exceeded the MTCA Method B cleanup level (0.00182 mg/L) in the shallow perched aquifer in three wells (13S, 17S, and 18S) in both the wet and dry seasons, and in well 23S in the wet season, and well 25S in the dry season. All 1,4,-dichlorobenzene concentrations are well below the primary MCL of 0.075 mg/L (maximum detected concentration of 0.0036mg/L). UCL95s for manganese exceeded the secondary MCL of 0.05 mg/L at all downgradient wells except 18D and 25D, and exceeded the Method B cleanup level of 2.24 mg/L at five wells (13S, 13D, 14S, 17S, and 18S) in both the wet and dry seasons, and well 14D in the dry season. Other secondary MCLs were exceeded in all downgradient wells in the shallow perched and upper regional aquifers except at wells 18D and 25D. In the lower regional aquifer, UCL95 values exceeded secondary MCLs for iron and manganese. These values are interpreted to be due to natural conditions because no other leachate indicator parameters displayed elevated concentrations.

Time series plots were also prepared to help evaluate post-capping water quality trends at and near the landfill. Figures 7 and 8 display multi-well time series plots for specific conductance in the shallow perched and upper regional aquifers, respectively. Specific conductance provides a general measure of the water quality impacts associated with the landfill. There is an apparent decrease in concentration over time for this constituent, indicating a general improvement in water quality. Figures 9 and 10 display multi-well time series plots for ammonia concentrations in the shallow perched and upper regional aquifers, respectively. Ammonia and nitrate represent different oxidation states for nitrogen, with ammonia as a source of nitrate at the landfill. The figures show a general decrease in ammonia concentrations in both aquifers, again indicating a general improvement in water quality. Lastly, Figures 11 and 12 display multi-well time series plots for nitrate in the shallow perched and upper regional aquifers, respectively. The figures show the sporadic nature of the nitrate concentrations. Regression lines for the data trend upward, but significant data variability reduces confidence in the regression lines.

6. Cleanup Standards

As stipulated in the regulations implementing MTCA, (WAC 173-340-700 (2)(a)), establishing cleanup standards for a site requires the specification of cleanup levels (concentrations protective of human health and the environment) and points of compliance (location where the cleanup levels must be attained).

Groundwater Cleanup Standards

WAC 173-340-720 requires that cleanup levels for groundwater be established based on the highest beneficial use of the affected groundwater and the maximum reasonable exposure expected to occur under current and potential future site use conditions. The highest beneficial use of groundwater at the site is for drinking water. Therefore, cleanup levels are established based on exposure to hazardous substances through ingestion of drinking water, which represents the reasonable maximum exposure at the site.

Cleanup levels for the site were established using MTCA Method B (WAC 173-340-720(3)). This process considers Applicable, Relevant and Appropriate Requirements (ARARs) including Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (40 C.F.R. 141), and Secondary MCLs established under the Safe Drinking Water Act (40 C.F.R. 141). It also provides a method to calculate a cleanup level for hazardous substances for which sufficiently protective health-based standards have not been established under state and federal law. Table 1 presents ARARs, Method B formula cleanup levels, and the Site Cleanup Levels, which in this case are the most stringent of the three alternatives.

Table 1
GROUNDWATER CLEANUP LEVELS

Parameter	MCL Primary	MCL Secondary	Method B Formula Value	Cleanup Level
Nitrate	10 mg/L	NA	25.6 mg/L	**10 mg/L**
1,4-Dichlorobenzene	75 µg/L	NA	1.82 µg/L	**1.82 µg/L**
Iron	NA	300 µg/L	NA	**300 µg/L**
Manganese	NA	50 µg/L	2240 µg/L	**50 µg/L**
Total Dissolved Solids	NA	500 mg/L	NA	**500 mg/L**
Chloride	NA	250 mg/L	NA	**250 mg/L**
Sulfate	NA	250 mg/L	NA	**250 mg/L**
Specific Conductance	NA	700 µmhos/cm	NA	**700 µmhos/cm**

NA -Not Available

Groundwater Point of Compliance

Pursuant to WAC 173-340-720(6), when a hazardous substance will remain on site as part of a cleanup action, a conditional point of compliance may be set as close as practicable to the source of hazardous substances, not to exceed the property boundary, provided that all practicable methods of treatment are utilized at the site. As discussed in Section 8, all practicable methods of treatment will be utilized at the site. The point of compliance for the site will be a conditional point of compliance comprised of the existing LRI property boundary, except where the limits of waste exceed that boundary (central northern area of the Site owned by Pierce County), where the point of compliance will be the south boundary of 176th Street as shown on Figure 2.

7. SUMMARY OF REMEDIAL ACTION ALTERNATIVES

Ten remedial alternatives were evaluated in the Hidden Valley Landfill FS. Detailed descriptions of the alternatives are provided in the *Hidden Valley Landfill Feasibility Study Report* (EMCON Northwest, 1992). Remedial action alternatives evaluated in the Hidden Valley Landfill FS included assemblages of several components including: leachate control (capping), physical groundwater control (barrier wall), hydraulic groundwater control (pump and treat), waste removal, landfill gas control/recovery, surface water and erosion control, environmental monitoring, and the provision of a public water supply. Several technologies were evaluated to achieve each of these components. Three cover designs including a soil cover, a geomembrane cover, and a geocomposite cover, were considered for leachate control. Five technologies and several configurations were considered for construction of a barrier wall. Three well configurations and nine methods of treatment were considered in evaluating hydraulic groundwater control. Passive and active landfill gas control/recovery systems were considered. Technologies were initially screened for protectiveness, technical feasibility, and practicability, and then assembled to establish the ten remedial alternatives to be evaluated.

As stated in the National Contingency Plan, EPA expects that containment technologies such as capping will generally be appropriate for waste that poses a relatively low long-term threat or where treatment is not practicable. This approach is directly applicable to Hidden Valley Landfill, a municipal solid waste landfill that poses a relatively low, long-term threat.

8. PROPOSED REMEDIAL ACTION ALTERNATIVE

The remedial action objective is to minimize further production and migration of leachate contaminated groundwater in order to achieve cleanup standards at the points of compliance. After evaluating the ten alternatives presented in the FS report, the preferred remedial alternative is final landfill closure with post closure requirements outlined in Chapters 173-304 and 173-351 WAC, and compliance monitoring and institutional controls as approved by Ecology. This cleanup action was selected after (1) conducting a comprehensive review and screening of available technologies, (2) developing and screening ten feasible alternatives that would be protective of human health and the environment, and (3) conducting a detailed analysis of six alternatives (selected after screening) using the criteria established by EPA and Ecology.

The physical setting of the landfill limits the practicability of groundwater containment options. Construction of a barrier wall is not feasible as a result of the necessary depths (in excess of 100 feet), and the abundance of cobbles and boulders in the underlying strata. Pump and treat technologies would require excessively large pumping rates due to the hydraulic conductivity of the contaminated units. Risks associated with ingestion of groundwater near the landfill are low due to the limited extent (both temporal and spatial) of contaminated groundwater, and the general lack of groundwater use in the immediate vicinity of the landfill. These risks would not be appreciably reduced through groundwater containment. The difficulty, cost, and limited benefit makes pump and treat technologies impracticable. Waste removal is also considered impracticable.

Leachate control (capping), landfill gas control/recovery, and surface water and erosion control are corrective actions that have been implemented as part of landfill closure. These actions prevent human and animal contact with the waste, minimize the lateral and vertical migration of leachate contaminated groundwater by reducing the volume of leachate generated, and prevent the migration of landfill gas. In addition LRI and Pierce County will:

- Update the *Landfill Gas Management Plan* (EMCON, 1994) and continue operation of the landfill gas control and destruction system and monitor landfill gas in accordance with the updated plan.
- Update the *East Lined Area Closure Plan* (EMCON, 1996) to address the entire facility and maintain the final cover system and surface water control systems in accordance with the updated plan.
- Finalize the draft *Groundwater Compliance Monitoring Plan* (Kleinfelder, 2000) and continue monitoring groundwater in accordance with the approved final plan.
- Implement institutional controls, including filing deed restrictions approved by Ecology and included as Exhibit F of the Consent Decree.

All post closure activities will be conducted under the oversight of Ecology and the Health Department.

WAC 173-340-420 requires periodic review by Ecology of sites with cleanup actions that result in hazardous substances remaining at the site at concentrations that exceed MTCA Method A or B cleanup levels. This review will occur at least every five (5) years and will include an evaluation of:

- The effectiveness of the ongoing or completed cleanup actions. This will include an evaluation of all monitoring data collected under this CAP.
- New scientific information for individual hazardous substances or mixtures present at the site;
- New applicable state and federal laws for hazardous substances present at the site;
- Current and projected site uses; and

! The availability and practicability of MTCA's higher preference technologies.

Ecology will publish a notice of the review in the Site Register and will allow an opportunity for public comment. If Ecology determines that substantial changes in the cleanup action are necessary to protect human health and the environment at the site, Ecology will prepare a revised draft Cleanup Action Plan, provide opportunity for public comment, issue the final revised Cleanup Action Plan, and implement additional cleanup actions.

9. SELECTION OF CLEANUP ACTION

Presented below are the statutory and regulatory requirements for selecting a cleanup action along with descriptions of how the selected cleanup action meets each requirement.

Protection of Human Health and the Environment. The selected alternative will protect human health and the environment by minimizing leachate generation and controlling landfill gas. No adverse impacts to existing or future communities in proximity to the site are expected from implementing this alternative.

Groundwater use in the vicinity of the landfill is limited, and no significant impacts to any water supply wells are known to have resulted from the landfill. A hypothetical future human health risk could occur from the use of the Upper Regional aquifer as a drinking water source in the immediate vicinity of the landfill. The primary constituents of concern in groundwater are nitrate and manganese. The Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160-171(3)(c)) prohibits the installation of water supply wells within 1000 feet of the property boundary of a municipal solid waste landfill. Installation of drinking water supply wells is also prohibited by the *Comprehensive Plan for Pierce County* (Pierce County Planning and Land Services, 1994) within the urban growth boundary. These regulations provide assurance that contaminated groundwater emanating from the landfill will not be used as a drinking water source. Additional controls may be necessary if these regulations change.

Compliance with Cleanup Standards. The selected cleanup action will continue to minimize the volume of leachate generated. Cleanup standards will be achieved in the shallow perched and upper regional aquifers from the points of compliance to the outer boundary of the existing plume through natural attenuation in a reasonable period of time.

To ensure that human health and the environment are being protected, the cleanup action shall be reviewed every five years by Ecology.

Compliance with Applicable, Relevant and Appropriate Requirements (ARARs). The following ARARs apply to the site:

A. State Standards

Model Toxics Control Act Cleanup Regulation (Chapter 173-340 WAC)

Hazardous Waste Cleanup - Model Toxics Control Act (Chapter 70.105D RCW)

State Environmental Policy Act (Chapter 197-11 WAC)

Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC)

Water Pollution Control (Chapter 90.48 RCW)

Minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC)

Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC)

Dangerous Waste Regulations (Chapter 173-303 WAC)

Washington Clean Air Act (Chapter 70.94 RCW)

Washington Industrial Safety and Health Act (WISHA) regulations (WAC296-62-300)

B. Federal Laws and Regulations

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations (40 CFR 300)

Resource Conservation and Recovery Act (RCRA) regulations (40 CFR 261 and 264)

Occupational Safety and Health Act (OSHA) regulations (29 CFR subpart 1910.120)

Federal Water Pollution Control Act of 1972 (Clean Water Act) regulations (40 CFR 122, 131,and 132)

Water Quality Act of 1987

Safe Drinking Water Act of 1974 regulations (40 CFR 141 and 143)

The above list of ARARs does not preclude subsequent identification of applicable state and federal laws (WAC 173-340-360 (10)(a)(vii)). The selected cleanup action is capable of complying with all of the above ARARs.

Compliance Monitoring. The following compliance monitoring will be included as part of the selected cleanup action:

Protection monitoring will be provided to ensure protection of human health and the environment during the operation and maintenance period of the landfill cover system.

Performance monitoring will be provided to confirm the cover system has achieved cleanup standards, and all other performance criteria (ARARs).

Confirmational monitoring will be provided to confirm the long-term effectiveness of the landfill cover system after cleanup standards and performance criteria have been achieved.

A compliance monitoring plan shall be prepared and submitted to Ecology and the Health Department for review and approval.

Long-term Effectiveness and Permanence. The selected remedial action will remain effective in the long-term, provided long-term monitoring and maintenance occur. A geomembrane cap is a proven and accepted technology by EPA and Ecology for application at landfills. Inspection and maintenance of the closure system will ensure long-term effectiveness for isolating the waste from the surface and preventing infiltration of surface water into the landfill. Monitoring will be addressed by implementing the compliance monitoring plan. Maintenance will be addressed by implementing the Post Closure Plan.

Short-term Effectiveness. Human health and the environment were protected during previous construction of the landfill cover system. The only short-term impact resulting from implementing this alternative was dust generated during grading and installation of the cover liner. The generation of dust during construction was minimized by using water, as necessary. The duration of construction was relatively short, and therefore the short-term risks were and are minimal.

Permanent Reduction in the Toxicity, Mobility, and Volume of Hazardous Substances. Since it is not practicable to remove the contents of the landfill, there is no practicable way to reduce the toxicity or volume of hazardous substances within the landfill. The mobility of hazardous substances has been reduced through the installation of the final cover system. The final cover system will minimize the vertical and lateral migration of leachate contaminated groundwater by reducing the quantity of leachate generated.

Ability to be Implemented. Many elements of the selected cleanup alternative have been implemented. The landfill has been closed, the cover system and associated engineering controls are complete, and required post-closure requirements will begin later this year. The restrictive covenants have been approved and will be filed when the cleanup action plan is finalized.

Cleanup Costs. The cost of the selected cleanup action includes costs incurred to date for design and installation of the landfill cover system, the landfill gas control/recovery system, surface water and erosion control measures, and the groundwater and landfill gas monitoring network of approximately $10,000,000, as well as the annual cost for ongoing maintenance, monitoring, and analysis and reporting of generated data. As required under WAC 173-304 and 173-351, post-closure maintenance and monitoring activities shall continue for at least a 30-year period or until the Health Department and Ecology find that post-closure monitoring has established that the facility has stabilized (i.e., little or no settlement, gas production, or leachate generation). In addition, WAC 173-340-360 (8)(b) requires long-term monitoring and institutional controls to continue until residual hazardous substance concentrations no longer exceed site cleanup levels at the point of compliance. As discussed previously, the incremental cost of higher preference cleanup actions (e.g., groundwater containment/treatment) are considered to be substantial and disproportionate to the incremental degree of protection provided over the selected cleanup action.

Reasonable Restoration Time Frame. The selected cleanup action will achieve groundwater cleanup standards from the points of compliance to the outer boundary of the existing plume through source control and natural attenuation. It is impossible to specifically quantify the time necessary to meet standards. Data collected to date indicate that capping has resulted in a downward trend in contaminant concentrations downgradient of the landfill. Given the limited existing risk to human health and the environment, the limited use of the groundwater resource in the vicinity of the landfill, the impracticability of achieving a shorter restoration time frame, the ready availability of alternative water supplies, the institutional controls on groundwater use in the area, and the ongoing monitoring at the site, the selected cleanup action provides for a reasonable restoration time frame.

Community Concerns. Community acceptance will be evaluated based on the comments received during the public comment period. Public comments will be considered during the preparation of a final CAP.

REFERENCES

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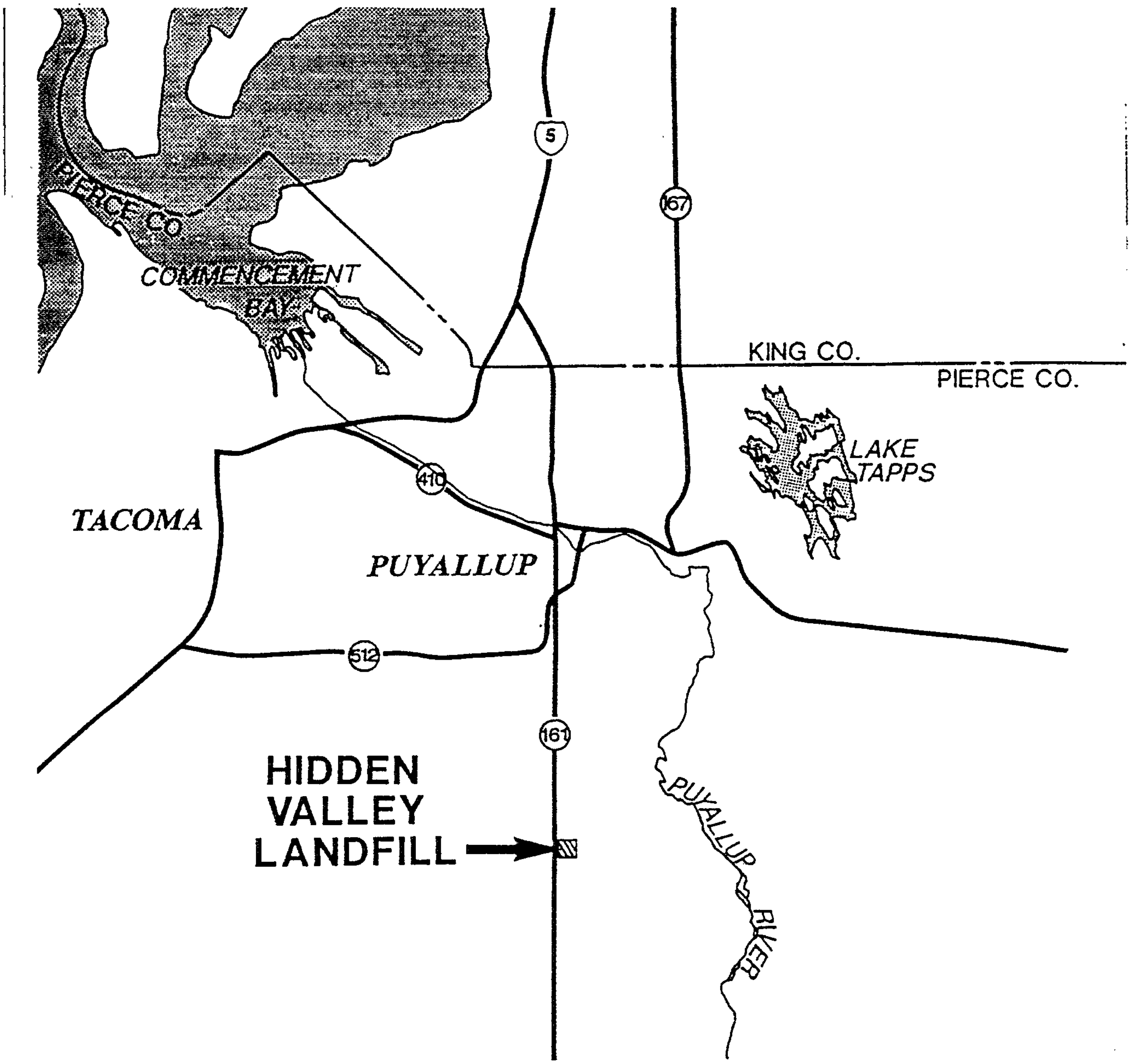
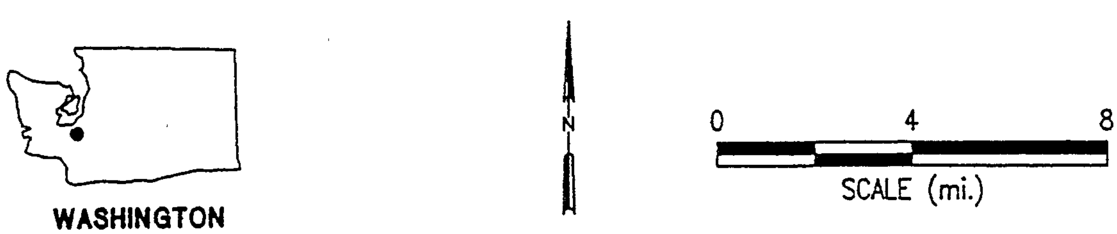
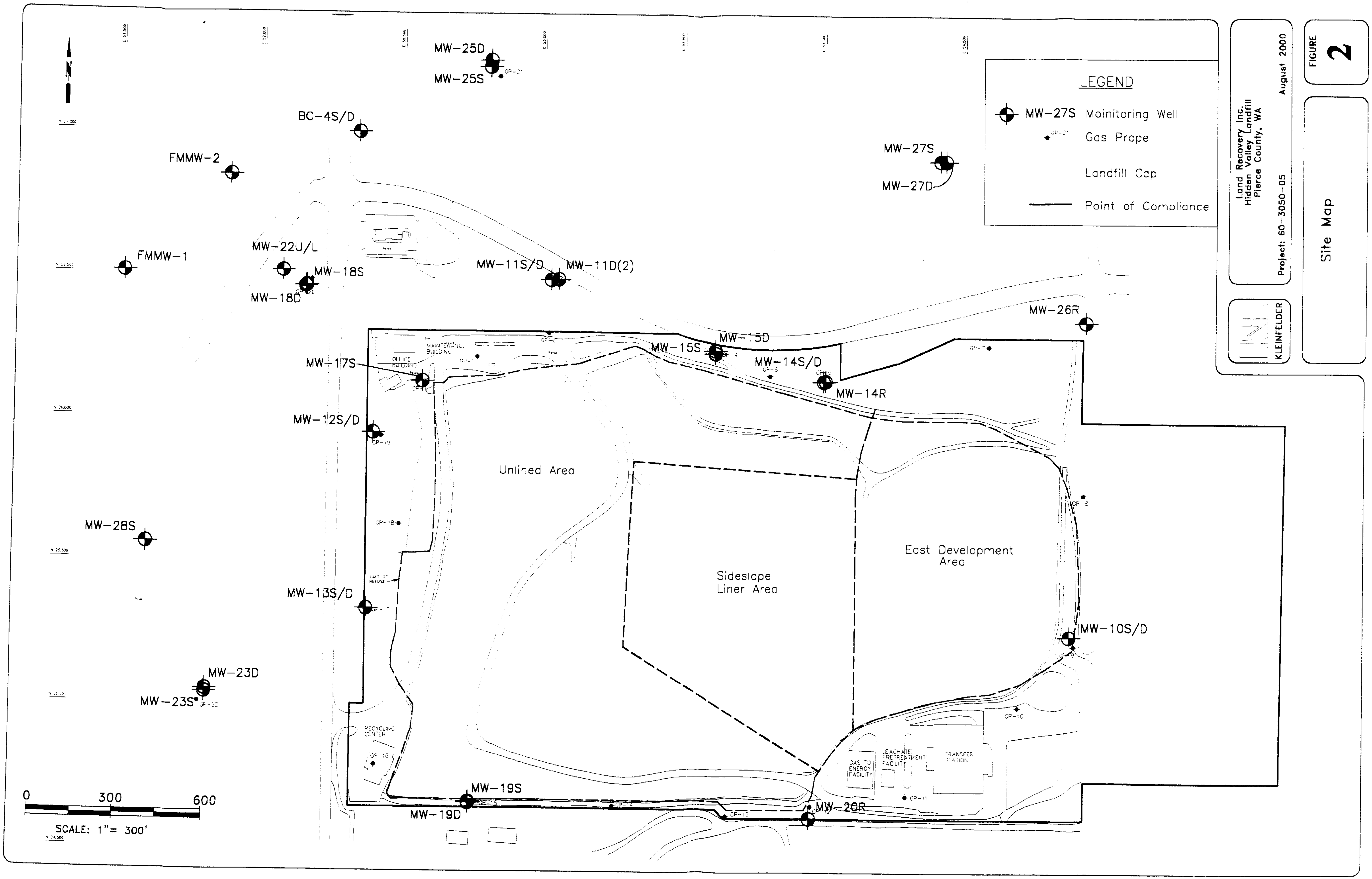
Sweet-Edwards/EMCON, Inc., *Technical Memorandum No. 3, Infiltration of Ground Water, Hidden Valley Landfill,* July 3, 1991

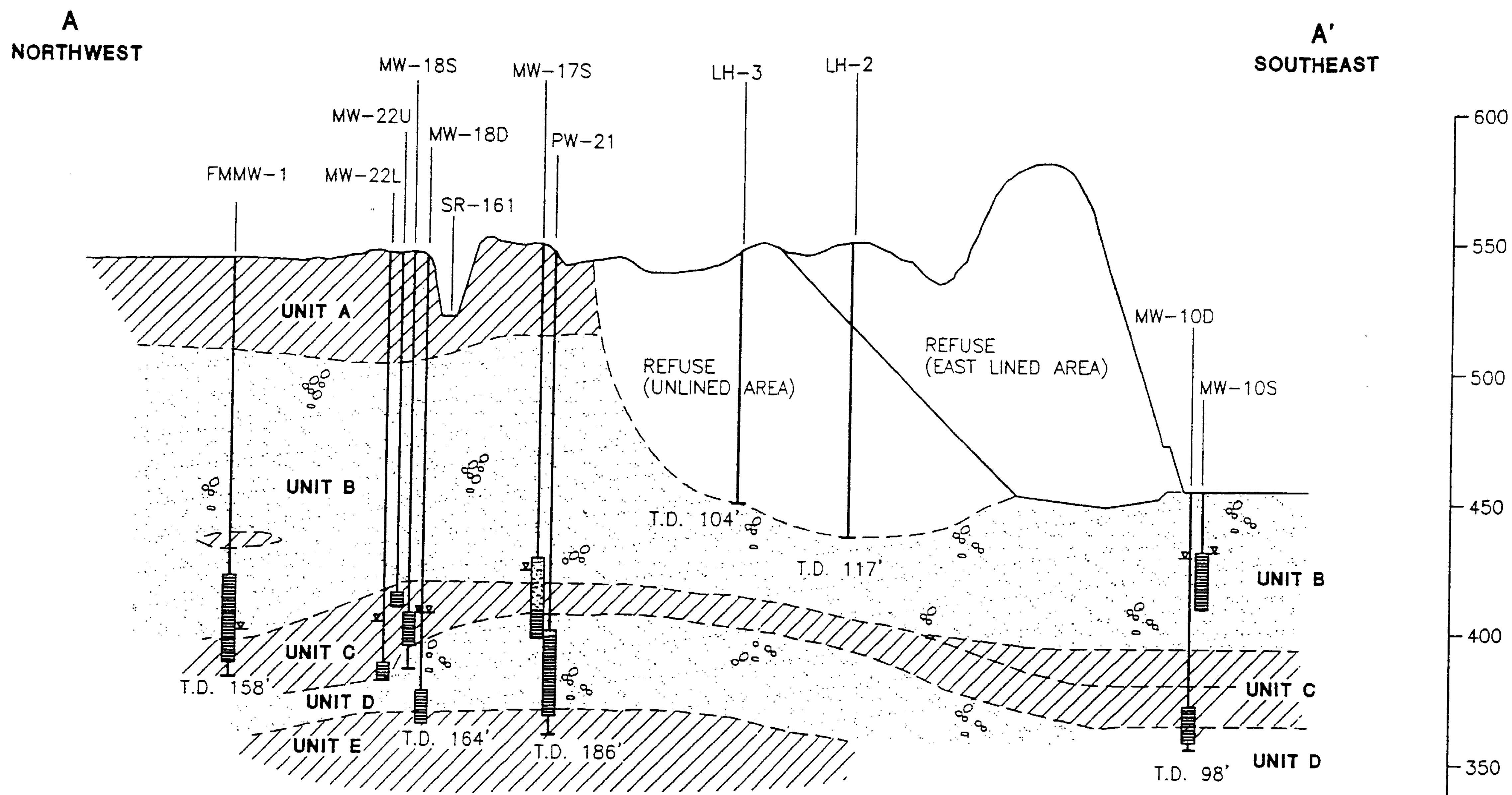




Reference: Hidden Valley Landfill, Hydrogeologic Report Addendum
Emcon, December 1998.

KLEINFELDER Project: 60-3050-06 August 2000	Site Location Map Land Recovery Inc. Hidden Valley Landfill Pierce County, WA	FIGURE 1


LEGEND
MW-27S Moinitoring Well
Gas Prope
Landfill Cap
Point of Compliance
MW-25D
MW-25S
BC-4S/D
FMMW-2
FMMW-1
MW-22U/L
MW-18S
MW-18D
MW-11S/D
MW-11D(2)
MW-27S
MW-27D
MW-26R
MW-15D
MW-15S
MW-14S/D
MW-14R
MW-17S
MW-12S/D
MW-28S
MW-13S/D
MW-23D
MW-23S
MW-19S
MW-19D
MW-20R
MW-10S/D
MAINTENANCE BUILDING
OFFICE BUILDING
Unlined Area
Sideslope Liner Area
East Development Area
LIMIT OF REFUSE
RECYCLING CENTER
GAS TO ENERGY FACILITY
LEACHATE PRETREATMENT FACILITY
TRANSFER STATION
0
300
600
SCALE: 1"= 300'
Land Recovery Inc.
Hidden Valley Landfill
Pierce County, WA
August 2000
Project: 60-3050-05
KLEINFELDER
FIGURE
2
Site Map



LEGEND:

UNIT A	Upper Vashon Till
UNIT B	Recessional Outwash
UNIT C	Lower Vashon Till
UNIT D	Advance Outwash
UNIT E	Upper Salmon Springs Till

Filter Pack

Screened Interval

T.D. Total Depth

Water Level on June 24, 1998, Except FMMW-1, August 1996

0 500 1000

SCALE (ft)

Vertical Exaggeration = 10X

NOTE: Topography based on August 1998 aerial photograph.

Reference: Hidden Valley Landfill, Hydrogeologic Report Addendum Emcon, December 1998.

Land Recovery Inc.
Hidden Valley Landfill
Pierce County, WA

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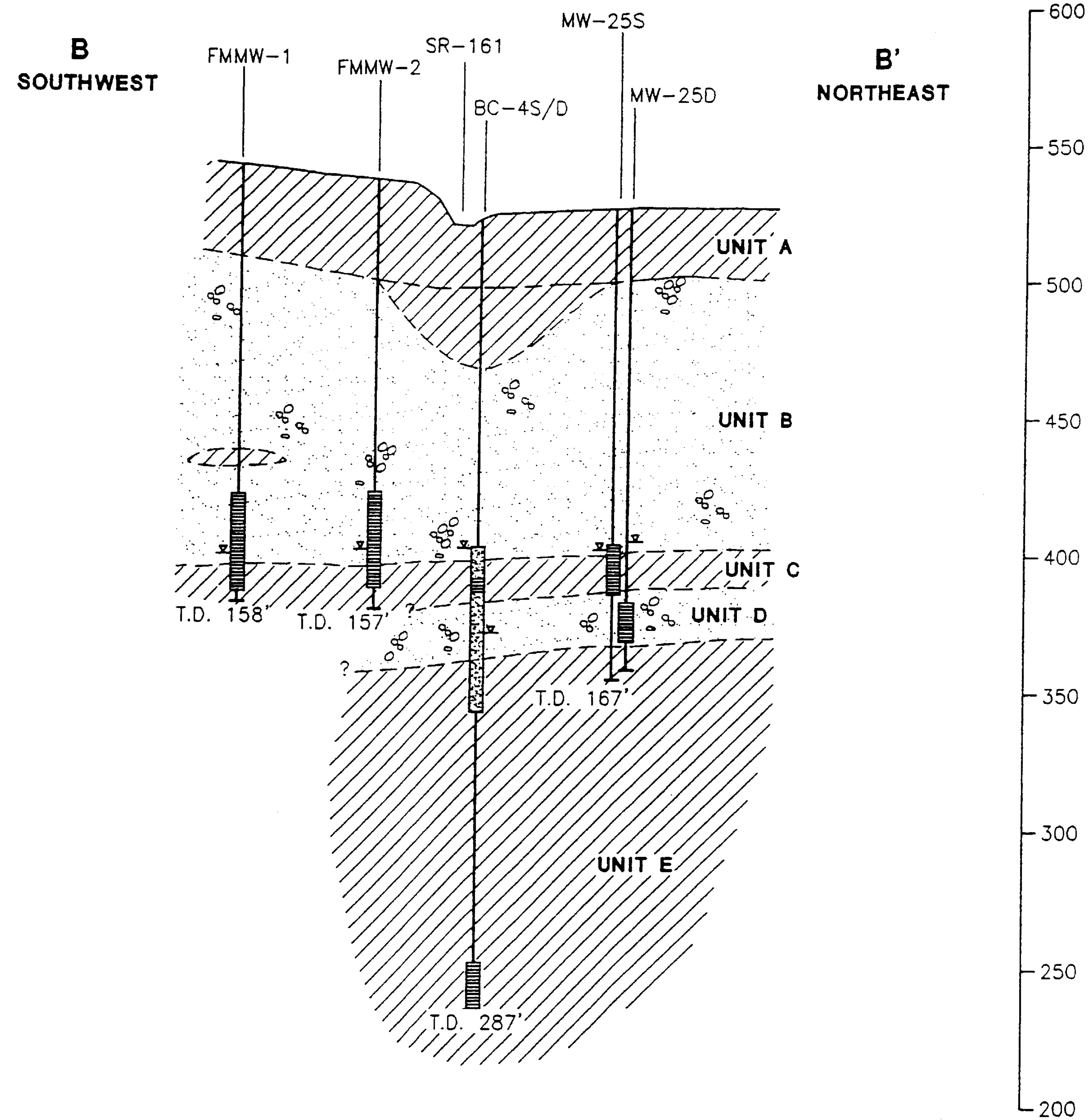
KLEINFELDER

Geologic Cross-Section A-A'

FIGURE 3



LEGEND:

UNIT A Upper Vashon Till
UNIT B Recessional Outwash
UNIT C Lower Vashon Till
UNIT D Advance Outwash
UNIT E Upper Salmon Springs Till

Filter Pack
Screened Interval
T.D. Total Depth
Water Level on June 24, 1998, Except FMMW-1 and FMMW-2, August 1996

0 500 1000
SCALE (ft)
Vertical Exaggeration = 10X

NOTE: Topography based on August 1998 aerial photograph.

Reference: Hidden Valley Landfill, Hydrogeologic Report Addendum
Emcon, December 1998.

Land Recovery Inc.
Hidden Valley Landfill
Pierce County, WA

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Geologic Cross-Section B-B'

FIGURE 4

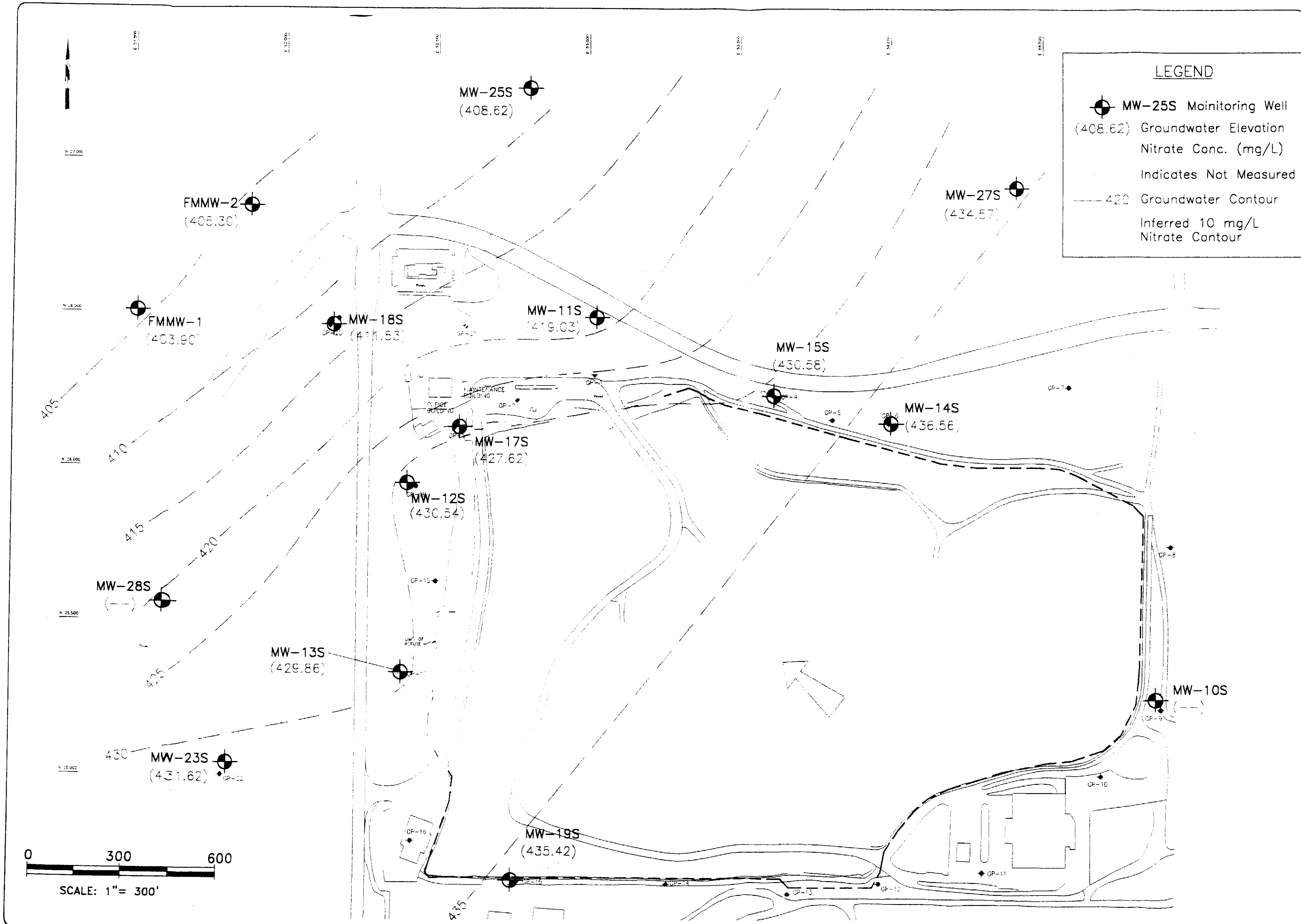

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FIGURE 5

March 2000 Nitrate Distribution
Shallow Perched Aquifer

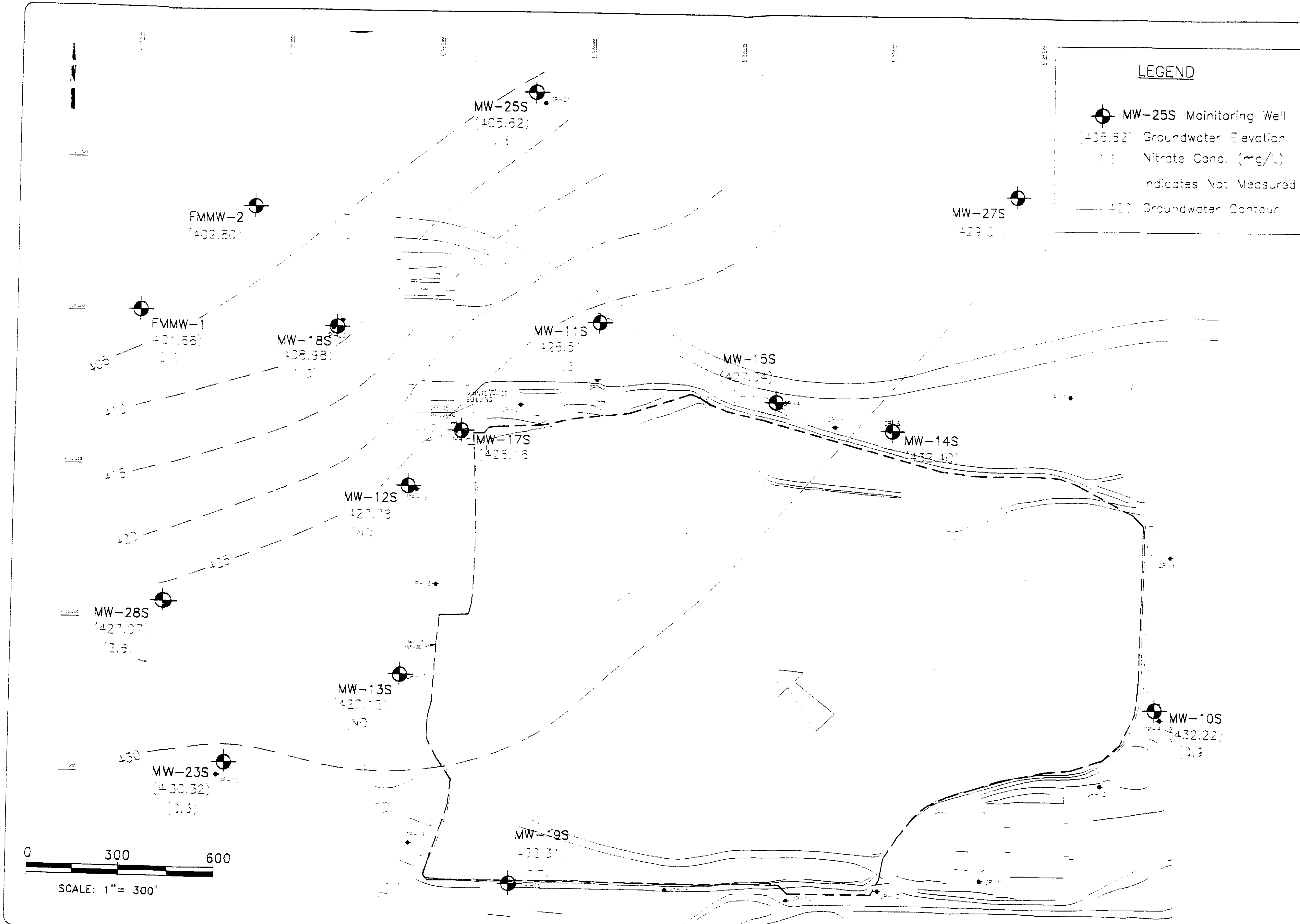

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FIGURE 6

June 2000 Nitrate Distribution
Shallow Perched Aquifer

Figure 7
Specific Conductance
Shallow Perched Aquifer, Hidden Valley Landfill
Wells MW-11S, MW-13S, MW-14S, and MW-17S

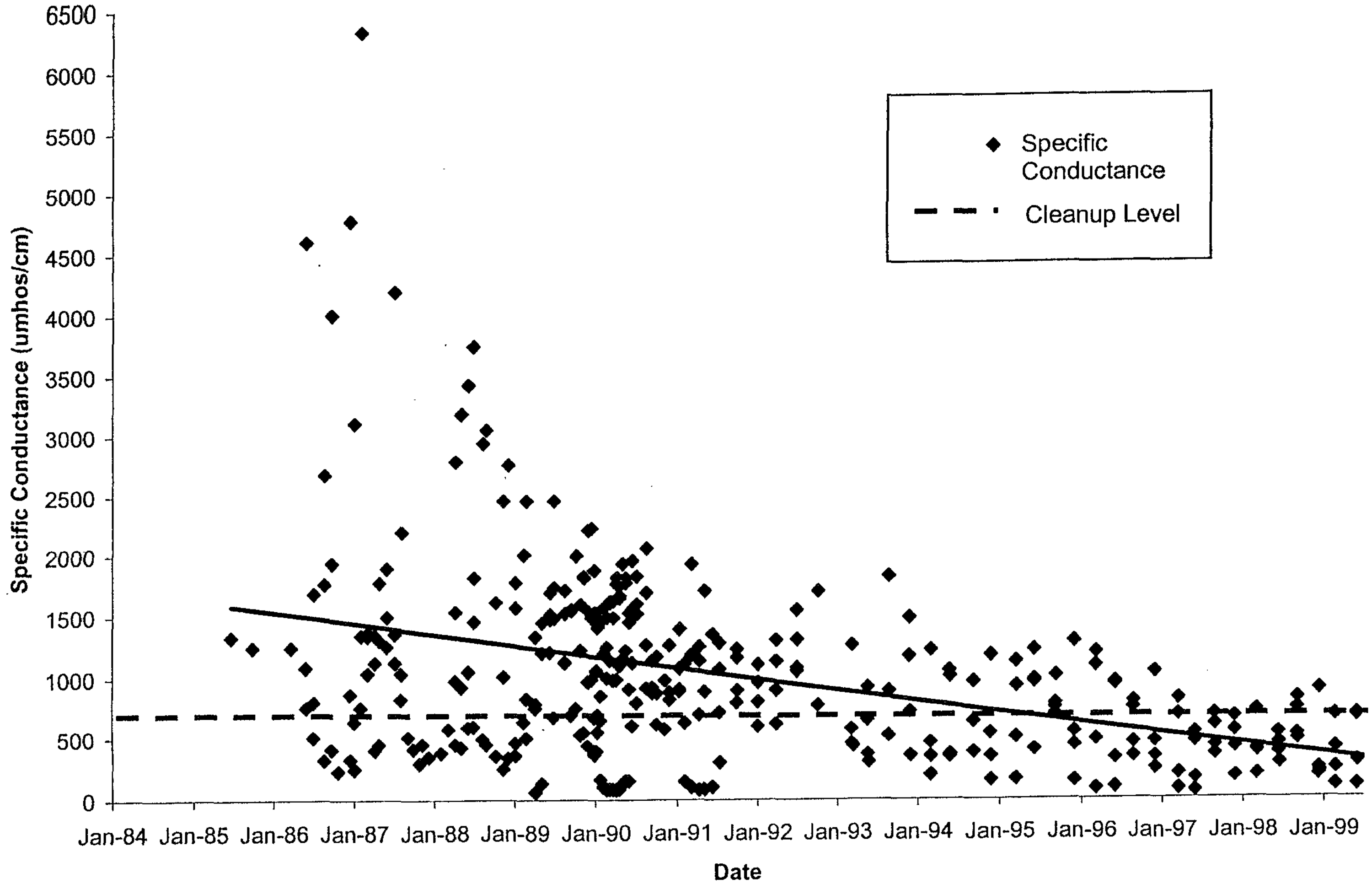

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Figure 8
Specific Conductance
Upper Regional Aquifer, Hidden Valley Landfill
Wells MW-11D, MW-13D, and MW-14D

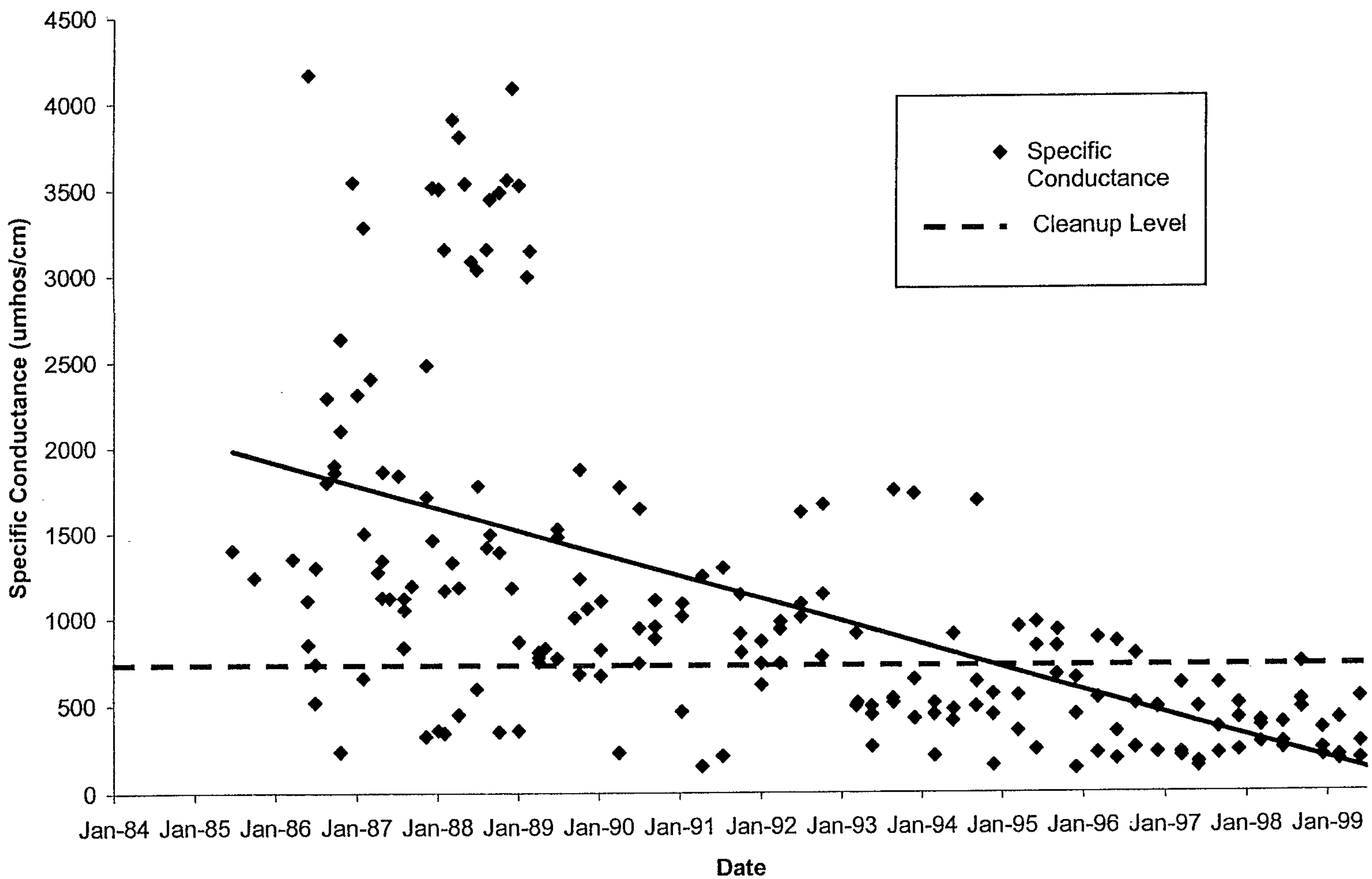

Figure 9
Ammonia Concentration
Shallow Perched Aquifer, Hidden Valey Landfill
Wells MW-11S, MW-13S, MW-14S, and MW-17S

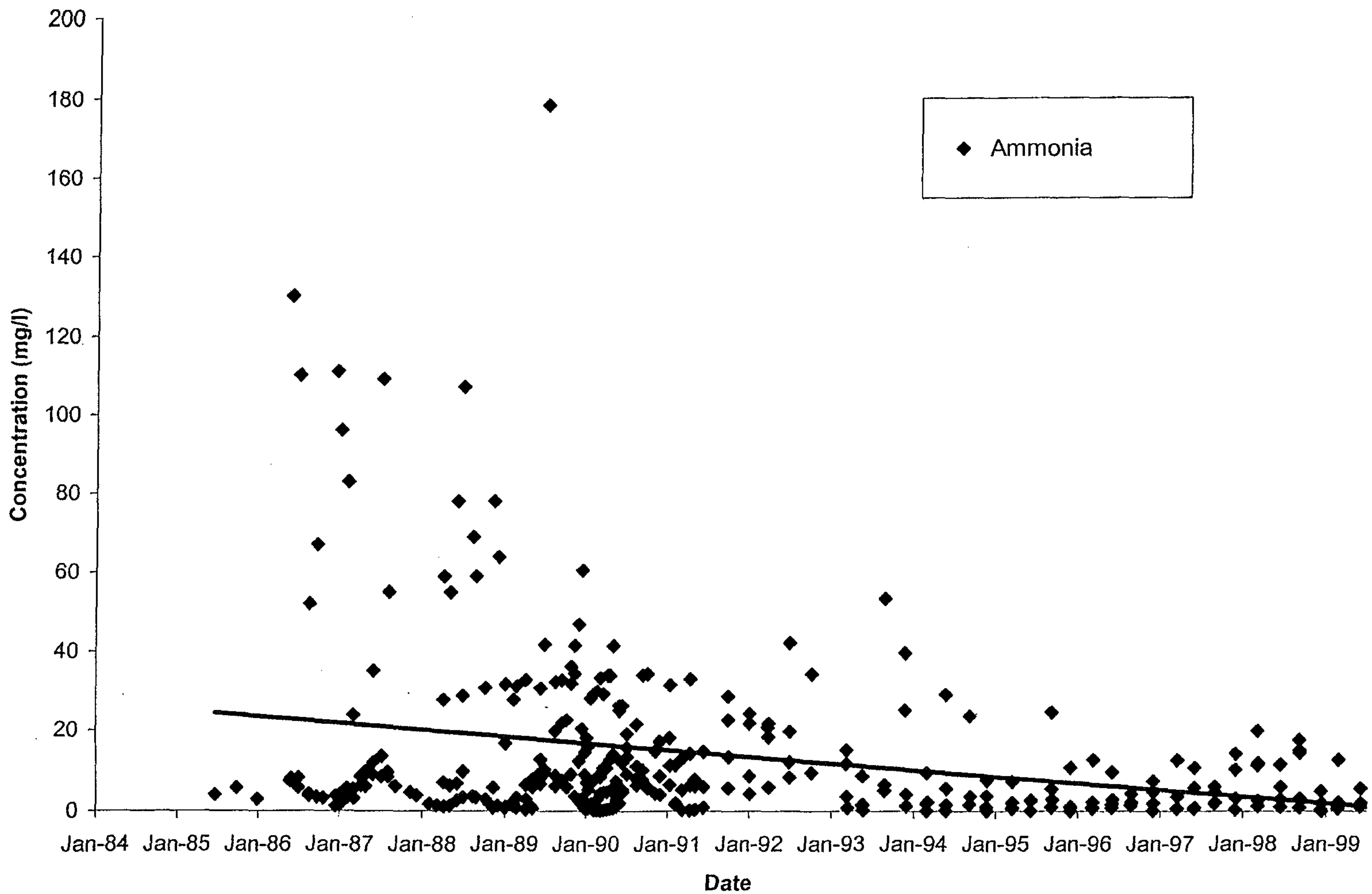

Figure 10
Ammonia Concentration
Upper Regional Aquifer, Hidden Valley Landfill
Wells MW-11D, MW-13D, and MW-14D

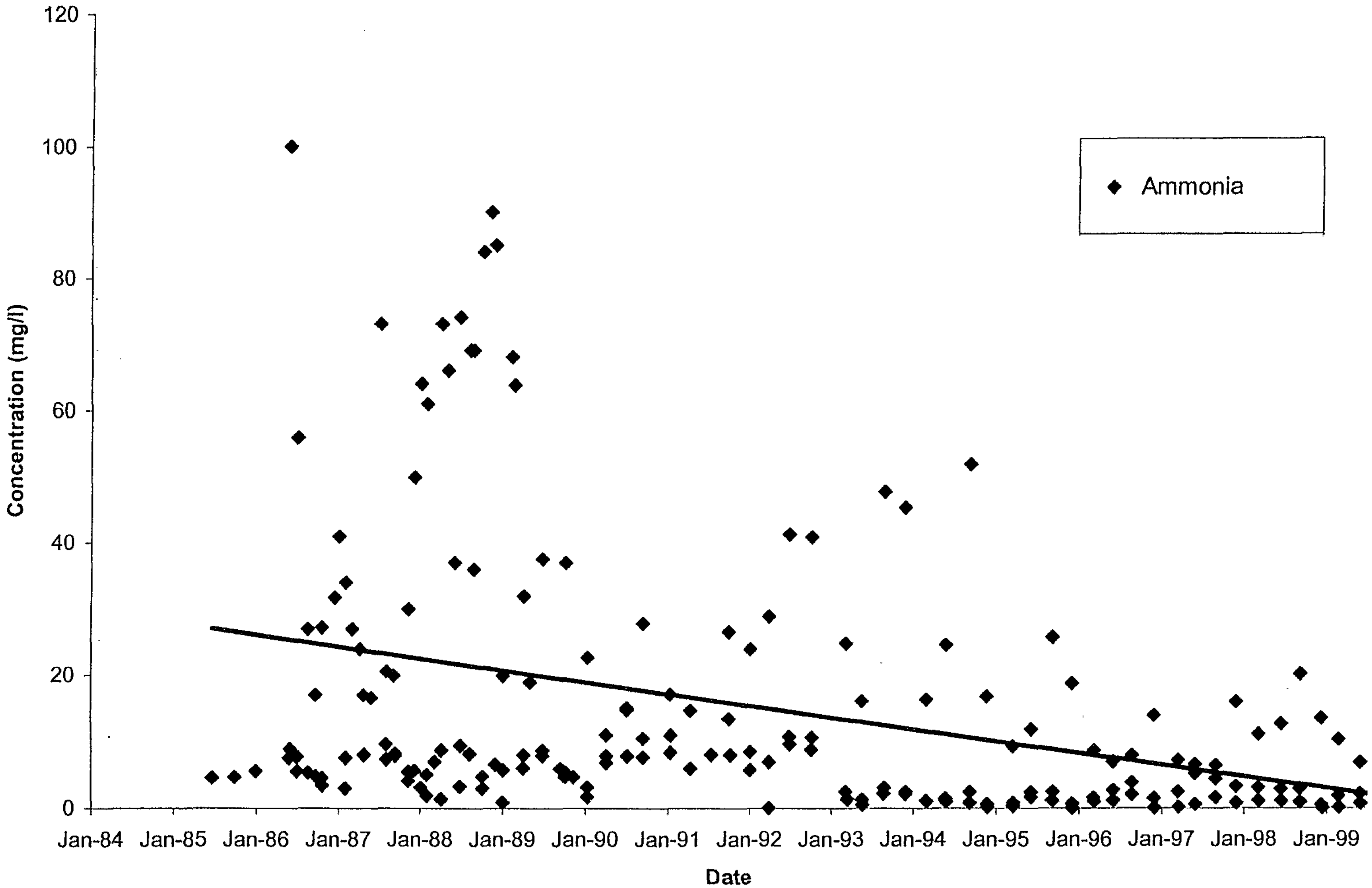

Figure 11
Nitrate Concentration
Shallow Perched Aquifer, Hidden Valley Landfill
Wells MW-11S, MW-13S, MW-14S, and MW-17S

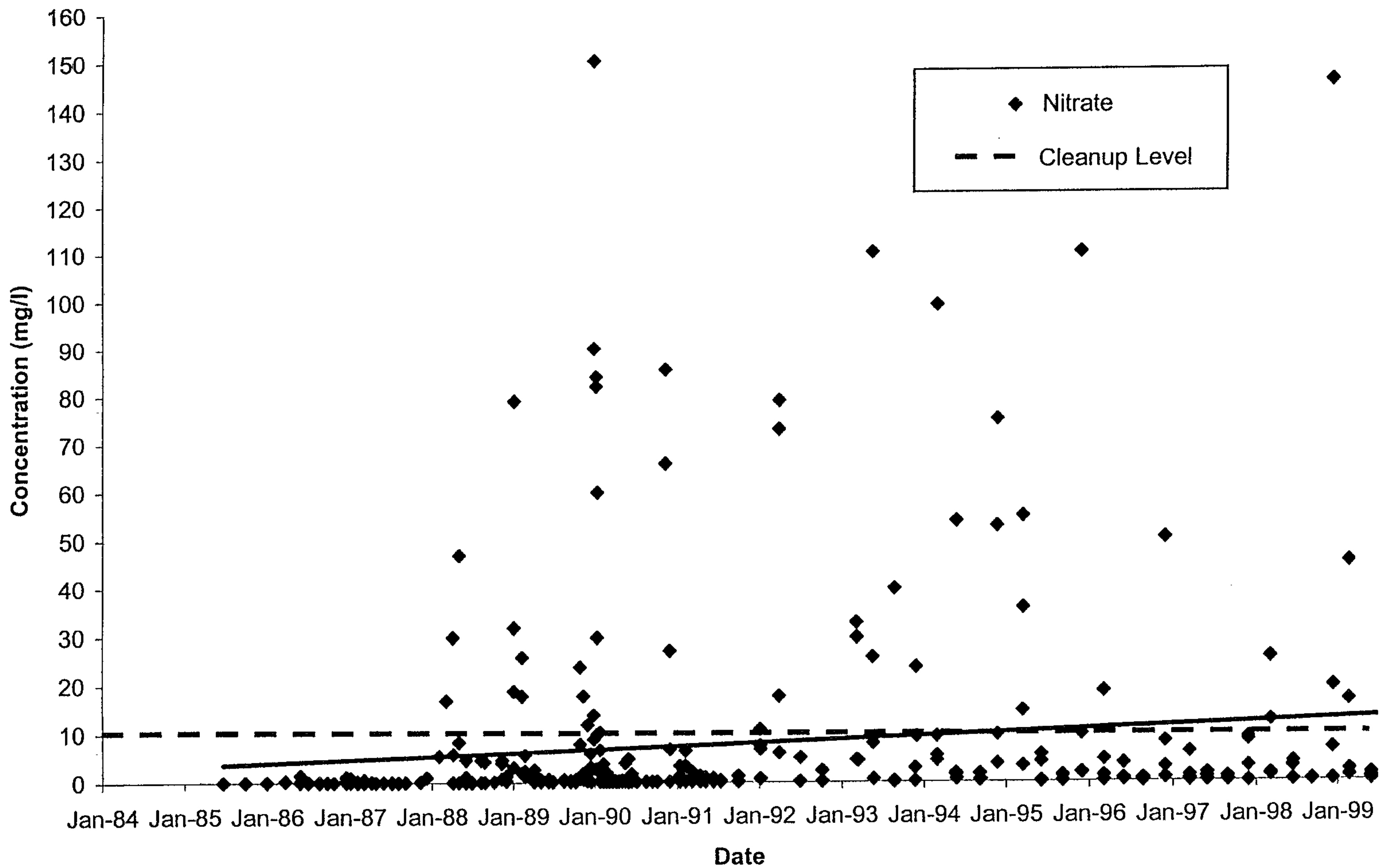

Figure 12
Nitrate Concentration
Upper Regional Aquifer, Hidden Valley Landfill
Wells MW-11D, MW-13D, and MW-14D