Second Five-Year Review Report

for

MIDWAY LANDFILL
Superfund Site

Kent, Washington

SEPTEMBER 2010

PREPARED BY:

United States Environmental Protection Agency
Region 10
Richland, Washington

Approved by:

Daniel D. Opalski, Director
Office of Environmental Cleanup
U.S. EPA, Region 10

Date:

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List of Acronyms and Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
City	City of Seattle
COCs	Contaminants of Concern
DCA	Dichloroethane
DCE	Dichloroethene
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
HDPE	High-density Polyethylene Membrane
I-5	Interstate 5
LEL	Lower explosive level
MCLs	Maximum Contaminant Levels
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
NGA	Northern Gravel Aquifer
NPL	National Priorities List
NTU	Nephelometric Tubidity Unit
O&M	Operations and Maintenance
PCE	Tetrachlorethene
PCOR	Preliminary Close Out Report
RAG	Remedial Action Goal
RAO	Remedial Action Objective
RI	Remedial Investigation
RPM	Remedial Project Manager
ROD	Record of Decision
SA	Sand Aquifer
SGA	Southern Gravel Aquifer
TCE	Trichloroethene
TCA	Trichloroethane
UGA	Upper Gravel Aquifer
USACE	U.S. Army Corps of Engineers
VOCs	Volatile Organic Compounds
WAC	Washington Administrative Code

EXECUTIVE SUMMARY

The remedy for the Midway Landfill included an active gas control system, landfill surface filling and grading, storm water detention pond landfill cap installation, Linda Heights Park storm water diversion, groundwater monitoring, and institutional controls. The Site achieved construction completion in 1992 under a Consent Decree between Washington State Department of Ecology and the City of Seattle. However a Record of Decision (ROD) was not signed until 2000, which initiated the requirement for five-year reviews, the first of which was completed in 2005. This is the second five-year review.

This five-year review found that the landfill gas collection, cap, and surface water drainage systems are functioning as intended. Methane concentrations outside the landfill boundary are below the lower explosive level (LEL). The flare/blower station, landfill cap, and surface water drainage system appeared to be well maintained. Groundwater monitoring continued biannually for the past five years. Institutional controls consistent with the ROD requirements and current site conditions are in place where necessary and are functioning as intended. Contaminants of concern (COCs) are still being detected in groundwater beyond the landfill boundary, but COC concentrations are trending downwards in downgradient wells and are below or approaching the Remedial Action Goals. However, during the last five-year review, 1,4 dioxane was added to be monitored in three groundwater wells (two upgradient and one downgradient). It was detected in all three wells, but only exceeds cleanup standards in the one downgradient well. Monitoring in three wells is not enough to develop a conceptual site model for 1,4 dioxane.

A protectiveness determination of the remedy at the Midway Landfill cannot be made at this time until further information on 1,4 dioxane is obtained. Further information will be obtained by adding one well (MW-7B) to the monitoring network and adding 1,4 dioxane to be sampled in all monitoring wells. The City of Seattle has agreed to incorporate this additional well and contaminant in the monitoring network. It is expected that the protectiveness determination can be made after two rounds of sampling are completed, which is estimated to be available by September 2012.

The Superfund Sitewide Human Exposure Environmental Indicator Status for the Site remains "Under Control." The landfill is fenced and capped, landfill gas is controlled and flared on-site, and no one is using contaminated groundwater. To ensure this indicator remains "Under Control" for the long term, the follow-up actions recommended in this review need to be completed.

The Groundwater Migration Environmental Indicator Status for the Site remains "Insufficient Data" because of the need for 1,4 dioxane data from the monitoring well network for several rounds to determine whether 1,4 dioxane is being released and migrating from the landfill. Collection and evaluation of additional groundwater data is a recommendation in this review, and the City has already agreed to collect the information such that conclusions should be able to be drawn by the Summer of 2012.

Cross Program Revitalization Measure Status: The Site continues to meet all the criteria and is to be considered "Ready for Anticipated Use."

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*: Midway Landfill

EPA ID *(from WasteLAN)*: WAD980638910

Region: 10	**State: WA**	**City/County: Kent, Washington**

SITE STATUS

NPL status: Final X Deleted Other (specify)_____

Remediation status (choose all that apply): Under Construction Operating X Complete

Multiple OUs?* YES NO X | **Construction completion date:** 09/21/2000

Has site been put into reuse? YES NO X [Site has been determined to be "Ready for Anticipated Use and a Reuse Assessment has been done, but Site remains a closed landfill]

REVIEW STATUS

Lead agency: EPA State X Tribe Other Federal Agency_____

Author name: Laura C. Buelow

Author title: Remedial Project Manager Author affiliation: U.S. EPA, Region 10

Review period:** 5 /2010 to 9/2010

Date(s) of site inspection: 6/29/2010

Type of review:

Post-SARA Pre-SARA NPL-Removal only
Non-NPL Remedial Action Site NPL State/Tribe-lead X
Regional Discretion

Review number: 1 (first) 2 (second) X 3 (third) Other (specify)_____

Triggering action:

Actual RA Onsite Construction at OU #____ Actual RA Start at OU#____
Construction Completion Previous Five-Year Review Report X
Other (specify)_____

Triggering action date (from WasteLAN): 9/28/2005 [Date of EPA signature]

Due date *(five years after triggering action date)*: 9/28/2010

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

ISSUES:

1. Upgradient sources of VOCs in groundwater will continue to limit the potential for the chemicals of concern in the SGA to decrease below the ROD cleanup levels, especially because the concentrations of volatile organic compounds in upgradient SA well MW-21B are increasing over time. Vinyl chloride is a daughter product of the ethenes and ethanes detected in upgradient wells, and both vinyl chloride and 1,2-DCA are also present upgradient of the landfill. Although this was a recommendation of the last five-year review, no efforts were made in the last five years by Ecology to identify the source of this contamination.
2. Downgradient wells that were initially part of the groundwater monitoring network in the UGA and the SA have gone dry. There are currently no downgradient wells in these aquifers.
3. 1,4 dioxane was added to the sampling round beginning in 2005, after the last Five-Year Review. It was detected in the three wells that it was sampled in (upgradient wells MW-17B and MW-21B and downgradient well MW-14B). The current sampling in only three wells does not provide adequate data to develop a conceptual site model for 1,4 dioxane.

RECOMMENDATIONS AND FOLLOW-UP ACTIONS:

1a. Investigate and clean up upgradient sources of VOC contamination. Encourage upgradient property owners to voluntarily clean up contamination.

1b. Ecology will notify property owners that have upgradient sources of contamination by September 2011. Ecology will advise the property owners on cleanup requirements. By September 2013, property owners need to take substantive action on the upgradient source.

2. Add well MW-7B to the monitoring network to further evaluate groundwater contamination in the SA.

3a. Add 1,4-dioxane to be sampled in all wells in the monitoring network.

3b. If 1,4-dioxane is found in downgradient wells at levels greater than upgradient wells, and above cleanup levels, then City of Seattle and Ecology need to meet and reevaluate the remedy.

PROTECTIVENESS STATEMENT

Protectiveness deferred. A protectiveness determination of the remedy at the Midway Landfill cannot be made at this time until further information on 1,4 dioxane is obtained. Further information will be obtained by adding one well (MW-7B) to the monitoring network and adding 1,4 dioxane to be sampled in all monitoring wells. The City of Seattle has agreed to incorporate this additional well and contaminant to the monitoring network. It is expected that the protectiveness determination can be made after two rounds of sampling are completed, which is estimated to be available by September 2012.

I. INTRODUCTION

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review Reports. In addition, Five-Year Review Reports identify issues found during the review, if any, and identify recommendations to address them. The U.S. Environmental Protection Agency (EPA) is preparing this Five-Year Review Report pursuant to CERCLA §121(c) and the National Contingency Plan (NCP). CERCLA §121(c) states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) which states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

Region 10 of the EPA conducted the Five-Year Review of the remedy implemented at the Midway Landfill, located in Kent, Washington. This Second Five-Year Review for the Midway Landfill was conducted by the EPA Remedial Project Manager (RPM) from May 2010 through September 2010. This report documents the results of the review. The triggering action for this statutory review was the completion of the First Five-Year Review Report, dated September 19, 2005. The five year review is required because hazardous substances, pollutants, or contaminants remain in the soil and groundwater above levels that allow for unlimited use and unrestricted exposure.

II. SITE CHRONOLOGY

September 2010.	Second Five-Year Review
September 28, 2005.	First Five-Year Review
September 21, 2000	PCOR is signed – site is construction complete
September 6, 2000	EPA completes a Record of Decision.
1991	Landfill cap and cover system construction completed.
1990	Consent decree between Ecology and City of Seattle.
1989	Landfill cap and cover system designed and construction started.
September 1988.	City of Seattle and Washington Department of Ecology sign Response Order on Consent
May 1986	Landfill Placed on National Priorities List.
October 1984	Landfill nominated to the National Priorities List.
1985	Removal action begun to extract migrating landfill gases.
1984	Methane gas discovered in surrounding residential area.
Fall 1983	City of Seattle closed the landfill.
1966-1983	Site leased by City of Seattle for use as a landfill.
1945-1968	Site operated as a gravel pit.

III. BACKGROUND

Site Location and Description

The Midway Landfill was placed on the National Priorities List (NPL) in May, 1986. The Washington State Department of Ecology (Ecology) is responsible for the oversight management of the site as stipulated by an agreement with Region 10 of the Environmental Protection Agency (EPA). The cleanup is managed by Ecology under the authority of the Model Toxics Control Act [Chapter 70.105D RCW], the Water Pollution Control Act [Ch. 90.48 RCW], and all other applicable state and federal laws.

The Midway Landfill is in King County, Washington, between Interstate-5 (I-5) and Highway 99, and between South 252nd Street and South 246th Street in Kent, Washington 98032. Figure 1 shows the regional site location. The location is in a geographic area known as the Puget Sound Lowland. The area has been glaciated several times and is underlain by a sequence of glaciofluvial sediments. The area has a maritime climate characterized by cool, wet winters and drier, mild summers. Annual rainfall is approximately 40 inches per year, which falls mainly between November and June.

Land use in the landfill vicinity consists primarily of commercial activities and residential areas. Commercial establishments and light industry and manufacturing border both sides of Highway 99 in the area. Two elementary schools, Sunnycrest Elementary School and Parkside Elementary School, and a city park, Linda Heights Park, are within a half-mile radius of the site. Most of the nearby residences are detached single-family dwellings, with some multi-unit residential developments to the south and west. Several mobile home parks are also in the vicinity.

Physical and Geographical Characteristics

The Midway Landfill is located near the crest of a narrow north-south trending glacier feature known as the Des Moines Drift Plain. This area, referred to as "upland" because of its location above adjacent valleys and sea level, is bordered by Puget Sound on the west and the Green River valley on the east. Maximum elevations along the crest of the upland generally range from 400 to 450 ft above mean sea level. Puget Sound is at sea level, and the Green River valley floor typically averages about 30 ft above mean sea level.

The Midway Landfill occupies a shallow, bowl-shaped depression (a former gravel pit) near the crest of the upland. The surface of the landfill generally ranges from 360 to 400 ft above mean sea level and slopes upward to the south and east. West of the landfill, the land surface is nearly flat across Highway 99 and then drops steeply downward approximately 100 ft to the Parkside Wetland. The upland area is cut with a number of steep-sided stream valleys. Midway Creek is located northeast of the landfill, and two other streams, the north and south forks of McSorley Creek, are located to the west and southwest, respectively. The Green River Valley is east of the Midway Landfill.

There is no major surface water body in the immediate vicinity of the Midway Landfill. The closest are Lake Fenwick, located approximately one mile to the southeast, and Star Lake, located approximately 1.5 miles to the south.

Synopsis of Hydrogeology Setting

The ground water conditions beneath the landfill are very complex. A brief synopsis is provided to describe the important hydrogeologic features of the landfill. Groundwater movement within and below the landfill has been characterized to an approximate depth of 300 to 350 ft below ground surface (50 to 100 ft above mean sea level). Several aquifers have been identified within this interval, including (from shallowest to deepest):

- Perched Aquifer (also referred to as Shallow Groundwater)
- Landfill Aquifer (also referred to as Saturated Refuse)
- Upper Gravel Aquifer (UGA)
- Sand Aquifer (SA)
- Southern Gravel Aquifer (SGA)
- Northern Gravel Aquifer (NGA)

A. Perched Aquifer (also referred to as Shallow Groundwater)

The Perched Aquifer was named during the remedial investigation (RI) when it was believed to represent shallow, discontinuous lenses of groundwater perched on low permeability deposits above the UGA. Field work and data analysis since completion of the RI indicate that while this groundwater is shallow and discontinuous, it is not always perched. The majority of these shallow zones are found north of the landfill. The Perched Aquifer is referred to as Shallow Groundwater in the remainder of this report.

B. Landfill Aquifer (also referred to as Saturated Refuse)
The Saturated Refuse consists of leachate within the landfill. Its occurrence and movement are largely functions of the former gravel pit topography. Flow in the Saturated Refuse is generally from the north and west toward the south central section of the landfill, where the pit excavations were deepest. Leachate likely discharges vertically throughout much of the landfill base, but the greatest volume of vertical flow is in the south central area.

C. Upper Gravel Aquifer (UGA)
A generalized potentiometric surface map of the UGA for October 2008 is presented in Figure 2. The UGA occurs immediately below the base of the landfill, is limited in lateral extent and is composed of silty and sandy gravel. Leachate discharging from the landfill enters the underlying UGA. The aquifer is typically semi-confined, although some parts are unconfined. Groundwater flow in the UGA is generally from both the north and south inward toward an area beneath the southern end of the landfill where the groundwater appears to discharge downward into the underlying SA. The UGA and SA are separated by the Upper Silt Aquitard, a discontinuous layer of fine-grained silt, clayey silt, and silty fine sand. Vertical flow from the UGA into the SA is most pronounced in places where the aquitard is absent.

D. Sand Aquifer (SA)
A generalized potentiometric surface map of the SA for October 2008 is presented as Figure 3. The SA occurs as a widespread deposit of interbedded sands and silts. Flow in this aquifer in the vicinity of the landfill is generally from the north and west to the southeast toward an apparent hydraulic sink. The sink occurs across a broad area beneath the southern part of the landfill and extends several hundred feet to the east. Groundwater south of this sink also flows towards the sink. Groundwater entering this sink appears to flow downward into the SGA. Some vertical flow outside the sink area also occurs from the SA downward into the SGA and NGA.

E. Southern Gravel Aquifer (SGA)
The SA and SGA are separated by the Lower Silt Aquitard. Like the Upper Silt Aquitard, the Lower Silt Aquitard is discontinuous and likely controls downward flow from the SA into the SGA. The deepest stratigraphic units studied are the NGA and SGA; they occur at about the same elevation, but hydraulic heads in the NGA are typically 100 ft higher than heads in the SGA. A generalized potentiometric surface map of the SGA for October 2008 is presented in Figure 4. The SGA is found beneath the southern half of the landfill and extends to the east, south, and west. It consists of permeable sands and gravel interbedded with silts and silty gravel. The SGA appears to be recharged by the SA and by lateral flow from the south. A groundwater mound in the SGA, below the hydraulic sink in the SA, is believed to be an expression of flow through the sink. Groundwater flow has changed slightly since the RI, with a more northeast/northwest direction instead of east/west. Flow to the north is blocked by higher potentiometric heads within the NGA. Groundwater in the SGA eventually discharges west to Puget Sound and east to the Green River Valley.

F. Northern Gravel Aquifer (NGA)
The NGA is found beneath the northern half of the landfill and extends to the north and northeast. Like the SGA, the NGA consists of permeable sands and gravel interbedded with silts

and silty gravel. Flow from the NGA is generally from north to south toward the SGA. Like the SGA, the NGA eventually discharges to Puget Sound and the Green River Valley.

G. Flow Rates

Flow rates within the aquifers and along critical flow paths are very difficult to estimate at Midway Landfill because of the complex stratigraphy and the strong vertical gradients. Based on evidence from calculated hydraulic conductivities, estimated porosities, and measured hydraulic heads, flow rates in the aquifers beneath Midway Landfill range from less than 0.01 to 10 ft per day. Given that flow rates of 0.1 to 1 ft per day are most likely, actions affecting leachate discharge or quality would be detectable in the groundwater monitoring network between 3 months and 30 years after they occurred. Note that the groundwater monitoring wells were selected in representative upgradient and downgradient sampling locations based on flow directions within each aquifer. Monitoring has been conducted at the site for over 15 years. Over this period, flow rates have been sufficient to allow observation of substantial changes in fluid level and chemical monitoring data in response to remedial actions.

Land and Resource Use

A. Land Use

Currently the landfill is capped and fenced. No public access is allowed. The most recent evaluation of potential future land use was a reuse planning report for Midway Landfill completed in February 2007. Below is a brief summary of the report:

- Four acres of the site have no refuse and minimal remedy components. They front the Pacific Highway South and could be potentially used for unrestricted uses in the near term.
- Seven acres have shallow (approximately 50 to 60 feet deep) refuse and have minimal surface remedy components. They could potentially be used for surface uses such as a parking lot or active recreation in the future.
- Fourteen acres house the site's flare station and retention pond, and these will be operational into the foreseeable future.
- There are nine acres that are a Washington Department of Transportation Right of Way that will be used in the future for an I-5 roadway widening project.
- Thirty-three acres where waste is moderately or deeply located have extensive surface remedy components. Alternate land uses in the future may be possible in the long term.

Occasionally there are inquiries from buyers of properties adjacent to or near the Midway Landfill. The inquiries request information on any environmental impacts to the property that the buyer may be interested in purchasing. Whenever such inquiries are received, the City of Seattle reviews the current environmental data with respect to the location of the property of interest. There have not been any inquiries from potential buyers in the last five years. An example information letter from the City of Seattle to prospective purchasers of adjacent or nearby properties is provided in Appendix B.

B. Groundwater Use

To the best of Ecology's and the City's knowledge, no one is drinking the groundwater from any aquifer within almost a mile of the landfill, and there are no current plans to use the groundwater near the landfill for drinking water. The closest wells currently in use for drinking water are the Lake Fenwick wells almost 1 mile southeast of the Midway Landfill. Monitoring Well MW-30 in the Southern Gravel Aquifer was added in 1988 to act as an early warning location should any measurable contamination from the landfill move toward the irrigation well or toward the Lake Fenwick wells. MW-30 is still monitored and has generally remained clean and unimpacted throughout the groundwater monitoring program. There are three public wells in the Midway Landfill area. Two are operated by the Highline Water District near the two intersections of South 209th Street and 31st Avenue South and South 208th Street and 12th Avenue South, respectively. These two wells are screened in the second confined aquifer at over 120 ft below sea level. Both are over two miles north and northwest from the landfill in an area upgradient of the landfill, and are completed in aquifers that are not connected to the affected aquifers. The third well is operated by the Kent Water District at South 212th Street and Valley Freeway and is used to satisfy peak summer demands. None of these municipal wells draw water from affected aquifers, and all are more distant from the landfill than are the Lake Fenwick wells. Neither water district has future plans to develop groundwater supplies from any aquifers within a one-mile radius of the Midway Landfill. The wellhead protection areas delineated by these utilities do not include the Midway Landfill site.

State regulations (WAC 173-160 -171) do not allow any new private drinking water wells within 1000 ft of a solid waste landfill or 100 ft of all other sources or potential sources of contamination, and notice is required to be given to Ecology prior to the construction of any well. However, the NCP is more stringent and requires EPA to consider all groundwater as drinking water except directly under a waste management area. The landfill area with refuse is a waste management area and thus is not considered a future drinking water source by EPA. All other areas downgradient of the landfill are considered to be potential future drinking water sources. However, it is likely that all future developments lie within water district service areas and, therefore, are not likely to rely on private wells for their potable water supply.

History of Contamination

From 1945 to 1966, the site of the current Midway Landfill was operated as a gravel pit. Originally, the pit was adjacent to a natural drainage basin often used as a settling pond. This basin, known as Lake Meade, was located northeast from the center of the present landfill. As the pit was mined, water was drawn from Lake Meade to wash silt and clay from the gravel and sand and then returned to the lake. This silt and clay settled on the lake bottom. Near the end of the gravel pit operation, the lake was drained into the southern end of the gravel pit, depositing a layer of clay and silt into the bottom of the pit. This layer of fine materials currently underlies much, but not all, of the present landfill.

In 1966, the City of Seattle leased the site and began using it as a landfill. From 1966 to 1983, approximately three million cubic yards of solid waste were deposited there. The exact dimensions of the bottom of the landfill are not known. However, existing boreholes indicate that the solid waste extends as deep as 130 ft in some places. The Midway Landfill was created

primarily to accept demolition materials, wood waste, and other slowly decomposing materials. However, some hazardous wastes and industrial wastes, including approximately two million gallons of bulk industrial liquids from a single source, were also placed in the landfill.

Initial Response

In 1980, a state-mandated screening process administered by the Seattle-King County Department of Public Health was initiated to eliminate the disposal of any hazardous waste into Midway Landfill. When the City closed the landfill in the fall of 1983, it began extensive testing of water and gas in the landfill and its vicinity. Samples of groundwater from monitoring wells in and around the landfill and gas samples from gas probes indicated the presence of organic and inorganic contaminants outside the landfill boundary.

In 1985, Ecology also began investigating the site and found methane gas in nearby residences. Beginning in September 1985, the City of Seattle constructed gas migration control wells within the landfill property and gas extraction wells beyond the landfill property to control the subsurface migration of gas. Gas was found to have migrated up to 2600 ft beyond the landfill prior to installation of the gas extraction system.

In 1986, the site was placed on the NPL by the EPA for groundwater conditions at the site. As required by the EPA, the City completed a remedial investigation, endangerment assessment, and a feasibility study.

In May 1990, prior to completion of the remedial investigation and feasibility studies, the City and Ecology entered into a consent decree pursuant to State of Washington Model Toxics Control Act (MTCA.) This legal agreement set forth Ecology's determination that undertaking certain remedial actions at Midway Landfill, prior to a Cleanup Action Plan (a MTCA decision document, similar to a Superfund ROD) would provide immediate protection to public health and the environment. In this consent decree, the City of Seattle agreed to finance and perform specific cleanup work. This cleanup work consisted of the elements described in the following sections.

A. Gas Control

An active gas control system was installed at the Midway Landfill. It originally included 87 gas extraction wells, 31 of which were located off the landfill in native soil. The off-landfill wells have since been abandoned or capped because gas has been removed from the offsite locations and is currently effectively controlled and removed onsite. In addition, approximately 70 off-landfill gas monitoring probes were installed to provide information on gas concentrations; about half of these probes have since been abandoned. The gas is extracted through the control wells at the landfill and routed to a permanent blower/flare system. Construction of the gas migration control system began in September 1985 and was completed in March 1991.

B. Landfill Surface Filling and Grading

The landfill surface was regraded, which increased the soil cover over the landfill by 2 to 14 ft. The engineered grades improved surface water runoff and decreased infiltration. The fill was

also compacted to reduce permeability and prepare the surface for the cover system. The work began in August 1988 and was competed in June 1989.

C. Storm Water Detention Pond

The storm water detention pond includes the landfill dewatering and discharge system. A lined detention pond was constructed to the north of the landfill. Regrading of the landfill surface redirected surface water to the new detention pond. Previously, the surface water infiltrated into the landfill. The detention pond is a 3-acre structure, lined with a 60-millimeter high-density polyethylene membrane (HDPE) to eliminate infiltration. The bottom of the pond was constructed below localized groundwater; therefore, a permanent dewatering system was also installed. Construction of the storm water detention pond began in August 1988 and was completed in June 1989.

D. Landfill Cap Installation

Construction of the final landfill cover began in October 1989 and was completed in May 1991. It consists of the following layers from bottom to top: a 12-inch-thick layer of low permeability (1 x 10-7 cm/sec) soil/clay material; a 50 millimeter HDPE flexible membrane; drainage net; filter fabric; 12-inch-thick drainage layer; and a 12-inch-thick topsoil layer.

E. Linda Heights Park Storm Water Diversion

The Linda Heights Park drain, a 30-inch culvert that drained directly into the landfill, was blocked. Storm water is now routed through a pump station and a pipeline to the detention pond. The old discharge line to the landfill is still in place and functions as an overflow in the event of a pump station failure. The construction of this rerouting began in August 1989 and was completed in 1991. The pump station and associated diversion of storm water was activated in January 1992.

F. Operations and Maintenance (O&M) Plan

A comprehensive operation and maintenance manual for both short-term and long-term operation and maintenance for the systems constructed under the consent decree was prepared by the City of Seattle and was approved by Ecology in April 1992. The 1990 consent decree also required the City to place a notice in the records of real property kept by the county auditor stating that the landfill was on the NPL and serve a copy of the consent decree upon any prospective purchaser, lessee, transferee, assignee, or other successor in interest to the property prior to the transfer of any legal or equitable interest in all or any portion of the landfill.

<u>Summary of Basis for Taking Action</u>

The basis for action was groundwater contamination above federal drinking water standards, or MCLs, in two monitoring wells east of the landfill and I-5. In addition, state groundwater cleanup levels under MTCA were exceeded. Because drinking this groundwater could result in an imminent and substantial endangerment to human health, remedial action was warranted at the Midway Landfill.

Contaminants of concern for groundwater include 1,2-dichloroethane, vinyl chloride, and manganese.

IV. REMEDIAL ACTIONS

A final remedy for Midway Landfill was selected in a ROD by EPA with Ecology's concurrence on September 6, 2000.

The remedial action objectives for the site were:

- To ensure containment is effective and working. Although not explicitly said in the ROD, containment refers to containment of the waste by a landfill cap, containment of surface water infiltration by the landfill cap and the leachate collection basin, and containment of the gas by the gas extraction system.
- To ensure containment will be maintained.
- To return groundwater to drinking water standards and state cleanup standards downgradient of the landfill boundary.
- To ensure no residential exposure to groundwater until groundwater cleanup standards have been met.

The selected remedy consisted of:

1. Monitoring to:
(a) Determine if the remedial systems are working as designed,
(b) Determine the progress towards meeting the groundwater cleanup standards,
(c) Determine if adequate containment is maintained when and if major changes are approved by Ecology in the operation of the site, such as turning off or scaling down the gas collection system, and
(d) Demonstrate that the cleanup levels have been achieved.

2. Continue to operate and maintain all remedial project elements required in the Ecology/City of Seattle 1990 consent decree, including the gas collection system, the multilayered cap, and the storm water collection system.

3. Implementing institutional controls that help ensure the long-term protectiveness of the remedy. At this site, the limited action alternative includes three types of institutional controls. Details on the institutional controls are in the Remedy Implementation section.

ROD Cleanup Goals

The cleanup levels set in the ROD are shown in Table 1.

Table 1. List of Contaminants of Concern and Cleanup Standards

Contaminant	Cleanup Level	Basis of the Cleanup Level
Manganese	2.2 mg/L	MTCA Method B
1,2-dichloroethane	5 µg/L	Federal Drinking Water Standard (MCL)
Vinyl chloride	0.02 µg/L*	MTCA Method B.

NOTES:
(*) Pursuant to WAC 173-340-707(2), Ecology will utilize the practical quantification limit (PQL) of 0.2 µg/L to determine compliance with this cleanup standard because the cleanup standard is lower than the PQL.

1) 1,2-Dichloroethane and vinyl chloride are solvents. Vinyl chloride can also be formed in groundwater during the natural breakdown of other solvents. Manganese is a natural mineral in soil that dissolves into the groundwater because of the chemistry of the water leaving the landfill.
2) If other contaminants resulting from releases from the landfill are found in any downgradient monitoring well, cleanup levels, if necessary, will be established for these additional contaminants using the federal drinking water standards and MTCA.
3) The point of compliance for the groundwater will be at the edge of the landfill waste as specified in a Compliance Monitoring Plan to be approved by Ecology. Under MTCA, this location is considered a "conditional point of compliance." All groundwater downgradient of this point of compliance will need to meet these cleanup levels for contaminants resulting from releases from the landfill before the Midway Landfill is removed from the Superfund National Priorities List.

Remedy Implementation

A. Monitoring

The monitoring has been performed by the City of Seattle, while Ecology will continue to be the lead cleanup regulatory agency at the site. To evaluate the effectiveness of the remediation measures described above, the City has conducted performance and compliance monitoring programs at the Midway Landfill since 1989. These include fluid level monitoring, groundwater chemistry monitoring, and landfill gas monitoring that are performed on an ongoing basis. The current monitoring program is described in the Midway Landfill Monitoring Plan.

Fluid Level Monitoring

An extensive formal fluid level monitoring program began in October 1989 and has been conducted monthly, quarterly, or semi-annually. In 1993 the monitoring frequency was reduced to a semi-annual schedule. Fluid level monitoring was previously referred to as "Performance Monitoring" and is intended to track response of landfill leachate levels and shallow groundwater levels to remedial actions required by the consent decree. It includes collection of groundwater level and oil thickness measurements within the saturated portion of Midway Landfill (termed Saturated Refuse) and groundwater levels in the shallow groundwater surrounding the landfill (Shallow Groundwater). The fluid level monitoring network for the Shallow Groundwater and Saturated Refuse is shown in Figure 5. Fluid level monitoring is currently being conducted on a biannual basis and the current program consists of:

- Monitoring seven wells from the key hydraulic areas (south end, hydraulic sink, west side, central mound, Linda Heights, north end, north end shallow) of the landfill twice a year beginning in 2002 during Round 41. These wells monitor the Shallow Groundwater/Saturated Refuse (SG/SR). The measurements from these wells are being compared to historical data to evaluate continued effectiveness of the closure measures.

- Monitoring 61 additional wells from the SG/SR once every other year beginning in 2003. Measurements from these wells are being compared to historical data as described above and used to evaluate groundwater flow within the SG/SR and oil thickness trends.

Groundwater Chemistry Monitoring

Groundwater chemistry monitoring was initiated in February 1990 and has been conducted on a quarterly or semi-annual basis. As of 2010, the groundwater monitoring will be switched to annual sampling, to be conducted in the spring (April or May). Groundwater chemistry monitoring has also been referred to as "Compliance Monitoring" in previous documents and is intended to track the presence, concentrations, and migration of groundwater contaminants, both upgradient and downgradient of the landfill, to assess the effectiveness of the remedial actions.

The current groundwater chemistry monitoring program includes collection and qualitative analysis of groundwater samples collected from monitoring wells located upgradient and downgradient of the landfill and groundwater flow determination. The well locations currently used for groundwater level measurements are shown in Figure 6. The well locations currently used for groundwater chemistry monitoring are shown in Figure 7.

Landfill Gas Monitoring

Gas monitoring is conducted on a biweekly, weekly, monthly, or quarterly basis; it consists of checks for concentration, composition, temperature, flow, and velocity of gases.

B. Continue to operate and maintain all remedial project elements required in the Ecology/City of Seattle 1990 consent decree, including the gas collection system, the multilayered cap, and the storm water collection system.

The O&M requirements for Midway Landfill are described in Midway Landfill Operation and Maintenance Manual completed in 1992. This document is a comprehensive operation and maintenance manual for both short-term and long-term operation and maintenance for the systems constructed under the consent decree, was prepared by the City of Seattle, and was approved by Ecology in April 1992. The manual addresses operation and maintenance of all components of the remedy including: gas system, surface water systems, pump stations, landfill cover system, and roadway and site control.

Ecology continues to oversee the City's operation and maintenance activities. Operational changes can be approved by Ecology when such changes ensure that the site and remedy will remain protective. The Seattle King County Public Health Department is given the opportunity to review requested operational changes.

C. Implementing institutional controls.

The City of Seattle was required to place a notice in the records of real property kept by the King County auditor alerting any future purchaser of the landfill property, in perpetuity, that this property had been used as a landfill and was on EPA's National Priorities List, and that future use of the property is restricted. The use restriction shall comply with the post-closure use restrictions under the State of Washington's Criteria for Municipal Solid Waste Landfills, WAC 173-351-500(1)(I) and (2)(c)(iii). The City is responsible for ensuring future owners and

operators are made aware of these restrictions and that restrictions remain in effect and are complied with even in the event the property is sold or transferred.

The City is required to ensure continued operation and maintenance of the containment and monitoring systems if any portion of the property is sold, leased, transferred or otherwise conveyed.

The City of Seattle is required to send an annual written notice about the groundwater quality downgradient from the landfill to the Seattle-King County Department of Public Health, nearby water districts, locally active licensed well drillers, and Ecology.

Operations and Maintenance

Routine maintenance is completed for the gas collection system, landfill cap, and surface water drainage system as described in the Operations and Maintenance Manual (Parametrix, 1992). Figure 8 shows the locations of the on-site gas extraction wells, the flare/blower, and the detention pond. All routine maintenance records are kept on-site. There is no reporting requirement associated with the landfill cap, gas collection system or surface water drainage system.

The cost for annual Operations and Maintenance was between $260,000 and $332,000 annually for the last five years.

A. Landfill Cap

Maintenance at the landfill cap and gas collection system was evaluated during the site visit. At the time of the site visit, the vegetative cap was being mowed. Cap settlement or damaged areas were not observed. According to the City of Seattle, the cap is mowed 2-3 times per year and cap inspections are completed during landfill gas sampling events.

B. Gas Collection System

The motor blower/flare facility has been modified since the original construction. The current operation consists of one flare that was downsized to a 250 cubic feet per minute (cfm) flare in 2003 (so that gas augmentation was not necessary) and one 5-horsepower blower. One of the older flares remain in place as a backup to the smaller flare. All of the PC and PD extraction wells on the north and east side of the landfill have also been shut down. There have been no significant changes to the gas collection system in the last five years. A new generator was recently purchased in case of power outage, but has never been used. The flare has had no downtime in the last five years.

C. Surface Water Drainage System

Maintenance of the surface water drainage system was evaluated during the site visit. The I-5 pump station appeared to be well maintained. The station was designed with four pumps; however, only one pump is ever used. The pumps are periodically cleaned to ensure that they remain operational. City of Seattle reported that one of the pumps was cleaned in 2010.

The detention pond also appeared to be well maintained. The outlet discharge line from the detention pond to McSorley Creek is TV inspected every three to five years. In the event of an earthquake, each manhole on this line is inspected within 24 hours to ensure line integrity. The last inspection in 2006 revealed no problems.

V. PROGRESS SINCE LAST REVIEW

Protectiveness Statement from Last Review

"Based on the information reviewed and the site inspection, the remedial actions are protective of human health and the environment. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedial actions. Most of the cleanup levels for the contaminants of concern have been achieved. There is no other information that calls into question the protectiveness of the remedy."

Status of recommendations and follow-up actions from last review.

The status of the recommendations and follow-up actions from the last Five Year Review are shown in Table 1.

All of the recommendations and follow-up actions were followed except the investigation into upgradient sources of volatile organic compounds (VOCs). No investigations into upgradient sources or notification of property owners were done by Ecology in the last five years.

Table 1. List of Recommendations and Follow-up Actions from first Five Year Review and Current Status.

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affect Protectiveness ?	Status
Annual notice of groundwater contamination is sent to local licensed well drillers.	City of Seattle	Ecology	7/6/05	Y	Performed annually
Assess the results of the ongoing monitoring program to determine if additional work is needed.	City of Seattle	Ecology	Annual	N	Performed annually
Reassess the scope of monitoring on a 5-year interval depending on monitoring results.	City of Seattle	Ecology	Annual	N	Performed in this Five Year Review.
Change the cleanup level for vinyl chloride from 0.02 µg/L to 0.29 µg/L.	Ecology	EPA	October 2005	N	Done
Test monitoring wells 14b, 17B and 21B to ensure 1,4 dioxane is not present	City of Seattle	Ecology	November 2005	N	Performed annually, 1, 4 dioxane was found above clean up standards.
Investigate and cleanup upgradient sources of VOC contamination. Encourage upgradient property owners to voluntarily cleanup contamination.	Ecology	Ecology	2010	Y	Not performed.
Ecology will notify property owners by September 2006. Ecology will advise the property owners on cleanup requirements. September 2007 or 2008 is the planned time period for property owners to take substantive action on the upgradient source.	Ecology	Ecology	September 2006, 2007, 2008	Y	Not performed.

VI. FIVE-YEAR REVIEW PROCESS

Administrative Components

- **Members of the FYR team**
  Laura Buelow, EPA, Remedial Project Manager
  Ching-Pi Wang, Ecology, Project Manager
  Technical support from EPA and USACE (United States Army Corps of Engineers).

- **Schedule of review**

EPA Region 10 initiated the five-year review in May 2010 and scheduled its completion for September 2010. The EPA site review team was led by EPA Remedial Project Manager (RPM) Laura Buelow and also included EPA site attorney Ted Yackulic and EPA Community Involvement Coordinator (CIC) Caryn Sengupta. In May 2010, EPA had phone calls with the City of Seattle, Ecology, and USACE to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in place. A review schedule was established that consisted of the following activities:

- Community notification.
- Document review.
- Data collection and review.
- Site inspection.
- Five-Year Review Report development and review.

Documents Reviewed

Data Received from City of Seattle:

- Midway Detention Pond Surface Water Quality Data. January 2006 – April 2010.
- Landfill Gas Probe Data. January 2006 – May 2010.
- Flare Data. January 2006 – June 2010.

E^2 Inc. A Reuse Planning Report, Kent Highlands and Midway Landfills. Prepared for City of Seattle, Seattle Public Utilities and EPA Region 10 Superfund Redevelopment Initiative. February 2007.

Ecology 2005. First Five-Year Review Report for Midway Landfill Site, Kent, Washington. September 19, 2005.

Parametrix, Inc. 1992. Midway Landfill, Operation and Maintenance Manual, Prepared for Seattle Engineering Department, Solid Waste Utility. December 1992.

Parametrix, Inc. 2000. Midway Landfill Monitoring Plan, Prepared for City of Seattle, Seattle Public Utilities. April 2000.

Parametrix, Inc. 2009. Midway Landfill 2008 Annual Groundwater Monitoring Report Round 54. December 2009.

Washington State Department of Ecology (Ecology) 1990. Consent Decree. May 29, 1990.
U.S. Environmental Protection Agency (EPA) 2000. Record of Decision, Midway Landfill, Kent, Washington. September 6, 2000.

Data Review and Evaluation

A. Landfill Cap

According to the Midway Landfill Monitoring Plan, 63 probe locations, some with multiple completions, are required to be monitored weekly, monthly, or quarterly for combustible gas (primarily methane), oxygen, hydrogen sulfide, and static pressure. The data reviewed indicate that weekly monitoring no longer occurs. The monitoring plan should be updated with the current monitoring schedule and probe locations.

B. Gas Collection System

Gas monitoring data from January 2006 through May 2010 were reviewed for this Five-Year Review. Methane concentrations above the lower explosive level (LEL) (5%) were not detected during the last five years at any off-site monitoring location. Methane concentrations just below the LEL have been detected outside the landfill boundary and are limited to one probe location (AM) at the northeast corner of the landfill (Figure 9). Methane concentrations are highest in the shallow completion, screened from 25 to 40 below ground surface. Concentrations range from 0 to 4.7% by volume and appear to be relatively stable (Figure 10). The air monitoring gas probe is outside the influence of the current gas extraction system. If concentrations of methane persist near the LEL or indicate an increasing trend, passive venting methods may be necessary to reduce the potential for gas migration in this area.

C. Surface Water Drainage System

Surface water monitoring at the detention pond is required when the water level is above 1.0 ft. Water temperature, pH, dissolved oxygen, turbidity, and conductivity are measured at each inlet (landfill inflow, I-5 inflow, and Highway 99 inflow) and at the pond discharge outlet. Discharge is shut off if the turbidity exceeds 100 nephelometric turbidity units (NTUs). Exceedance of any other discharge parameters requires evaluation by the site supervisor.

Surface water quality data were reviewed for the last five years. With the exception of pH below 6.5, none of the water quality parameters at the discharge outlet have been outside the required parameters. The lower pH levels have been attributed to low rainfall pH and bird droppings. According to the City of Seattle, discharge from the pond has not required shutoff in the last five years.

D. Groundwater Flow

Potentiometric contour maps have been generated regularly with each monitoring round for the Upper Gravel Aquifer, the Sand Aquifer, and the Southern Gravel Aquifer. The most current results are shown in Figures 2-4.

In general, the fluid levels in the shallow groundwater and saturated refuse have declined over time and the overall shape of the potentiometric surface has undergone little change over the last 20 years. The overall flow patterns within and directly under the landfill have generally remained constant over time.

E. Water Quality Monitoring

The most recent groundwater quality results are published in the 2008 Annual Groundwater Monitoring Report. Summary tables of groundwater quality data and trend plots of key downgradient and upgradient wells are attached in Appendix C.

The cleanup level for 1,2-dichloroethane was exceeded in one upgradient well in the Sand Aquifer (MW-17B) and in one downgradient well in the Southern Gravel Aquifer (MW-29B) during the 2008 sampling rounds. This is significantly improved from the last five-year review, in which data from 2004 showed all five downgradient wells exceeded the cleanup level from 1,2 dichloroethane.

The cleanup level for vinyl chloride was exceeded in one upgradient well in the Sand Aquifer (MW-17B) and in four downgradient wells in the Southern Gravel Aquifer (MW-14B, MW-20B, MW-23B and MW-29B) during the 2008 sampling rounds.

Manganese has exceeded the cleanup level in one downgradient well (MW-20B) during the 2008 sampling rounds.

Three additional volatile organic compounds (1,1-DCE; tetrachloroethene [PCE]; and Trichloroethene [TCE]) have shown steadily increasing trends in upgradient well MW-21B. Concentrations of these VOCs are above applicable standards federal MCLs for drinking water, and MTCA Method B groundwater cleanup levels), and have shown increases over time.

The chemical 1,4-dioxane was added to the monitoring network after the last five year review. It has been continuously monitored in the upgradient SA wells 17B, and 21B and in the downgradient SGA well 14B since November 2005. 1,4-dioxane has generally decreased in wells 17B and 21B and is below the cleanup level in both wells. Well 14B has had a relatively steady level of 1,4-dioxane, and it is approximately two times higher than the MTCA Method B cleanup level.

Since the groundwater plume expands beyond the boundary of the landfill and there are residences in the area, vapor intrusion was considered in this five year review. 1,2-dichloroethane and vinyl chloride are sufficiently toxic and volatile to be considered a vapor intrusion threat . The highest samples from the 2008 groundwater sampling campaign were 6.3 μg/L for 1,2-dichloroethane and 0.97 μg/L for vinyl chloride. The Generic Screen Levels from OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance, November 2002, EPA530-D-02-004) were evaluated to determine if vapor intrusion needs to be further investigated.

For a 1×10^{-5} risk, the target groundwater concentration corresponding to target indoor air concentration are 23 μg/L for 1,2-dichloroethane and 2.5 μg/L for vinyl chloride.

For a 1 x 10^{-6} risk, the target groundwater concentration corresponding to target indoor air concentration defaults to the federal MCL, which are 5.0 µg/L for 1,2-dichloroethane and 2.0 µg/L for vinyl chloride. These are defaulted to the federal MCLs.

For both of these contaminants, the risk is less than the Washington State MTCA, which requires the cumulative excess cancer risk to be no greater than 1 x 10^{-5}. Therefore, vapor intrusion was not considered further and no issues or recommendations were identified.

F. Institutional Controls

Institutional controls have been properly followed over the last five years. EPA did an Institutional Controls review and had a Title Search done in August 2007 to determine whether the required deed restrictions had been recorded on all 8 parcels where they were required pursuant to the City's Consent Decree with Ecology, were still in place, and contained all the necessary restrictions. This review confirmed that the necessary restrictions had been recorded, but an online search of property records only turned up a restriction on one parcel. The City was notified of this issue and immediately rectified the problem such that online searches now reveal all the necessary restrictions. Verification of the institutional controls combined with the remedial actions that had already been completed formed the basis for EPA to make a Sitewide "Ready for Anticipated Use" determination in September 2007.

Annual notices have been sent to Ecology and nearby well drillers regarding the levels of contamination. A copy of the 2010 notice regarding downgradient groundwater conditions to Ecology is provided in Appendix D. In the letter, Table 2 refers to 2008 groundwater monitoring results shown in Appendix C in this five-year review, Figure 1 is the same as Figure 1 in this five year review, and Figure 2 is the same as Figure 7 in this five-year review. There is no indication that new drinking water wells have been installed within the 1,000 ft restricted area or the groundwater plume in the past five years.

All physical controls (e.g. fencing, gates and signage) have been properly maintained and are in good condition.

Community Notification

On June 11, 2010, a Public Notice was place in the *Kent Reporter* stating that EPA was performing this Five-Year Review and soliciting comment. A public notice of the completion of this Five-Year Review will be placed the *Kent Reporter* upon completion of this report.

Site Inspection

A site inspection was performed on June 29, 2010. Overall, the Site appeared to be in very good condition. All fences were intact, and gates were locked. There was no evidence of trespassers. The vegetation on top of the cap was approximately 12 to 18 inches deep, but was in the process of being mowed to prevent deep rooting plants from affecting the integrity of the cap. There was minor settlement of the surface cap. The storm water retention basin had abundant wetland vegetation, which helps to reduce the turbidity of the effluent. The mechanical equipment for the

Linda Heights Park storm water diversion and the gas extraction system appeared to be in good operating condition.

Participants:

Laura Buelow, EPA, Remedial Project Manager
Rebecca Gerhart, EPA, Environmental Scientist
Marlowe Laubach, USACE, Chemical Engineer
Sharon Gelinas. USACE, Geologist
Jeff Neuner, City of Seattle, Landfill Closure Business Area Manager
Min-Soon Yim, City of Seattle, Senior Environmental Analyst

The site inspection checklist and photographs from the site inspection are in Appendix E.

VII. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The landfill gas collection, cap, and surface water drainage systems are functioning as intended. Methane concentrations outside the landfill boundary are below the LEL. The flare/blower station, landfill cap, and surface water drainage system appeared to be well maintained. Groundwater monitoring continued biannually for the past five years. The groundwater COCs are trending downwards in downgradient wells and are below or approaching the Remedial Action Goals (RAG)s.

A.1 Removal Action Performance and Monitoring Results

Methane concentrations outside the landfill boundary are below the LEL. Consistent detections of methane are limited to one probe location, AM, located to the northeast of the landfill. Methane concentrations range from 0 to 4.7% by volume and appear to be relatively stable.

While the remedy is functioning as intended, three volatile organic compounds (1,1-DCE; tetrachloroethene [PCE]; and Trichloroethene [TCE]) have shown steadily increasing trends in upgradient well MW-21B. Concentrations of these VOCs are above applicable standards (federal MCLs for drinking water, and MTCA Method B groundwater cleanup levels), and have shown increases over time.

Upgradient sources of VOCs in groundwater will continue to limit the potential for the chemicals of concern in downgradient SGA wells to decrease below the ROD cleanup level and thus the Site from achieving completion, closeout, and deletion.

Also, several wells in the original monitoring network in the UGA and SA have gone dry. This indicates that the cap is functioning as intended and reducing recharge of the upper aquifers; however it also limits the information on downgradient contaminants in the UGA and SA.

A.2 System Operations and Maintenance

The gas collection system, landfill cap, and surface water drainage systems appear to be well maintained. The gas collection system has been modified from the original construction to increase efficiency and decrease operating costs. Cap settlement or damage were not observed during the site visit.

A.3 Costs of System Operations, Maintenance, and Monitoring

Budget documents indicate normal expenditures for system operations, maintenance and monitoring.

A.4 Opportunities for Optimization

There may be a time in the near future when overall landfill gas concentrations decrease significantly to the point that flare operation would require gas augmentation. In this case, determining the specific areas where significant gas concentration remains and concentrating extraction in these areas would optimize the gas collection system and minimize the quantity of natural gas required to augment the flare. There are no opportunities for optimization at the landfill cap or surface water drainage system.

A.5 Early Indicators of Potential Remedy Problems

Methane concentrations just below the LEL have been observed at gas monitoring probe, AM, located to the northeast of the landfill. This area is outside the influence of the current gas extraction system. If concentrations persist near the LEL or indicate an increasing trend, passive venting methods should be considered to reduce the potential for gas migration in this area. One upgradient groundwater well continues to have rising VOC levels. This may prevent downgradient wells from reaching RAGs and thus the Site from achieving completion, closeout and deletion.

A.6 Implementation and Review of Institutional Controls and Other Measures

Institutional controls have been properly implemented and maintained over the last five years. EPA did an Institutional Controls review and had a Title Search done in August 2007 to determine whether the required deed restrictions had been recorded on all 8 parcels where they were required pursuant to the City's Consent Decree with Ecology were still in place and contained all the necessary restrictions. This review confirmed that the necessary restrictions had been recorded but an online search of property records only turned up a restriction on one parcel. The City was notified of this issue and immediately rectified the problem such that online searches now reveal all the necessary restrictions. EPA concluded that the deed restrictions combined with the State prohibition on drinking water wells within 1,000 ft of a landfill were adequate and appropriate institutional controls for this Site, with a notation that Washington has adopted the Uniform Environmental Covenants Act, so under State law future proprietary institutional controls should take the form of a UECA covenant. Verification of the institutional controls combined with the remedial actions that had already been completed formed the basis for EPA to make a Sitewide "Ready for Anticipated Use" determination in September 2007.

Annual notices have been sent to Ecology and nearby well drillers regarding the levels of contamination. There is no indication that new drinking water wells have been installed within

the 1,000 ft restricted area or the groundwater plume in the past five years. All physical controls (e.g. fencing, gates and signage) are in good condition.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy are still valid.

B.1 Changes in Standards and To Be Considered:

Attachment 2 provides a table presenting an analysis of applicable or, relevant and appropriate requirements (ARARs) from the ROD to include any changes in standards and/or applicability or relevance and appropriateness.

Certain regulatory requirements followed by the City of Seattle in their operation of Midway Landfill were not included in the ROD. These include:

- Puget Sound Clean Air Agency (PSCAA); Regulations I through III; and
- Washington State Water Quality Standards

The cleanup level for vinyl chloride was changed in the last Five Year review to 0.29 µg/L from 0.02 µg/L. Nothing has changed since the last Five Year Review.

B.2 Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics.

Exposure assumptions
No baseline risk assessment was conducted for the site. However, an Endangerment Assessment was prepared as part of the 1990 RI/FS. This assessment determined that the only potential exposure pathway is discharge of leachate into the groundwater. Based on this assessment, the ROD determined that there are likely no current unacceptable risks to human health through gas migration or groundwater because gas migration has stopped and no one is currently drinking the groundwater. These exposure assumptions are still valid.

No ecological risks to plants or animals were expected in the ROD. This exposure assumption is still valid.

Toxicity Data
Even though no baseline risk assessment was conducted, potential future risk to groundwater exposure was estimated in the ROD. Toxicity values used to calculate the potential future risk were from either IRIS or Region 9 PRG tables. The following table presents the toxicity values from IRIS and Region 9 PRG tables from the time of the ROD compared to current values.

	ROD Values		Current Values	
Contaminant	IRIS	Region 9 PRG[1]	IRIS	Region 9 PRG
Vinyl Chloride (oral reference dose)	$3x10^{-3}$ mg/kg-day	$3x10^{-3}$ mg/kg-day	$3x10^{-3}$ mg/kg-day	$3x10^{-3}$ mg/kg-day
1,2-Dichloroethane (oral slope factor)	$9.1x10^{-2}$/mg/kg/day	$9.1x10^{-2}$/mg/kg/day	9.1x10-2/mg/kg/day	$9.1x10^{-2}$/mg/kg/day
Manganese (oral reference dose)	$1.4x10^{-1}$ mg/kg-day	$2.4x10^{-2}$ mg/kg-day	$1.4x10^{-1}$ mg/kg-day	$1.4x10^{-1}$ mg/kg-day

1 – Region 9 PRG values were not available on-line for 2000. Therefore these values represent the 2004 values which were the earliest values found.

The IRIS toxicity values have not changed since the ROD. Region 9 PRG values have not changed since the ROD except for manganese. It is not expected that this difference affects the remedy.

B.3 Changes in Land Use.
Land use has remained the same. A future project that expands the I-5 corridor in this area may affect the landfill. However, the project has not yet occurred.

B.4 Remedial Action Objectives.
The remedial objectives presented in the ROD are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. For groundwater, 1,4 dioxane was added to be monitored in three groundwater wells (two upgradient and one downgradient). It was detected in all three wells, but only over the cleanup level in the one downgradient well. Monitoring in three wells is not enough to develop a conceptual site model for 1,4 dioxane.

No other information has come to light for the gas collection, cap, and surface water drainage systems.

D. Technical Assessment Summary

While the remedy is functioning as intended, upgradient sources of VOCs in groundwater will continue to limit the potential for the COCs in downgradient SGA wells to decrease below the ROD cleanup level and thus the Site from achieving completion, closeout, and deletion.

Furthermore, downgradient wells that were initially part of the groundwater monitoring network in the UGA and the SA have gone dry. There are currently no downgradient wells in these aquifers. This is particularly an issue because of the "new information" issue identified in response to Question "C". 1,4 dioxane was added to the sampling round beginning in 2005, after the last Five Year Review. It was detected in the three wells that it was sampled in (upgradient wells MW-17B and MW-21B and downgradient well MW-14B). The current sampling in only three wells does not provide adequate data to develop a conceptual site model for 1,4 dioxane.

The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy are still valid.

VIII. ISSUES

Issue	Currently Affects Protectiveness? (Y/N)	Affects Future Protectiveness? (Y/N)
1) Upgradient sources of VOCs in groundwater will continue to limit the potential for the chemicals of concern in the SGA to decrease below the ROD cleanup levels, especially because the concentrations of volatile organic compounds in upgradient SA well MW-21B are increasing over time. Vinyl chloride is a daughter product of the ethenes and ethanes detected in upgradient wells, and both vinyl chloride and 1,2-DCA are also present upgradient of the landfill.	N	Y
2) Downgradient wells that were initially part of the groundwater monitoring network in the UGA and the SA have gone dry. There are currently no downgradient wells in these aquifers.	N	Y
3) 1,4 dioxane was added to the sampling round beginning in 2005, after the last Five Year Review. It was detected in the three wells that it was sampled in (upgradient wells MW-17B and MW-21B and downgradient well MW-14B). The current sampling in only three wells does not provide adequate data to develop a conceptual site model for 1,4 dioxane.	Y	Y

The following operation and maintenance issues which do not affect current or future protectiveness were also identified during the Five-Year Review:

- The Midway Landfill Operations and Maintenance Manual has not been updated since 1992 does not have the current landfill gas sampling locations and schedule and location of operational gas extraction wells.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affect Protectiveness?	
				Current	Future
1) a. Investigate and cleanup upgradient sources of VOC contamination. Encourage upgradient property owners to voluntarily cleanup contamination.	Ecology	EPA	2015	N	Y
1) b. Ecology will notify property owners that have upgradient sources of contamination by September 2011. Ecology will advise the property owners on cleanup requirements. By September 2013, property owners need to take substantive action on the upgradient source.	Ecology	EPA	September 2011 and 2013	N	Y
2) Add well MW-7B to the monitoring network to further evaluate groundwater contamination in the SA.	City of Seattle	Ecology	May 2011	N	Y
3) a. Add 1,4-dioxane to be sampled in all wells in the monitoring network.	City of Seattle	Ecology	May 2011	Y	Y
3) b. If 1,4-dioxane is found in downgradient wells at levels greater than upgradient wells, and above cleanup levels, then City of Seattle and Ecology need to meet and reevaluate the remedy.	City of Seattle	Ecology	May 2011	Y	Y

The following are operation and maintenance recommendations related to issues which do not affect current or future protectiveness identified during the Five-Year Review:

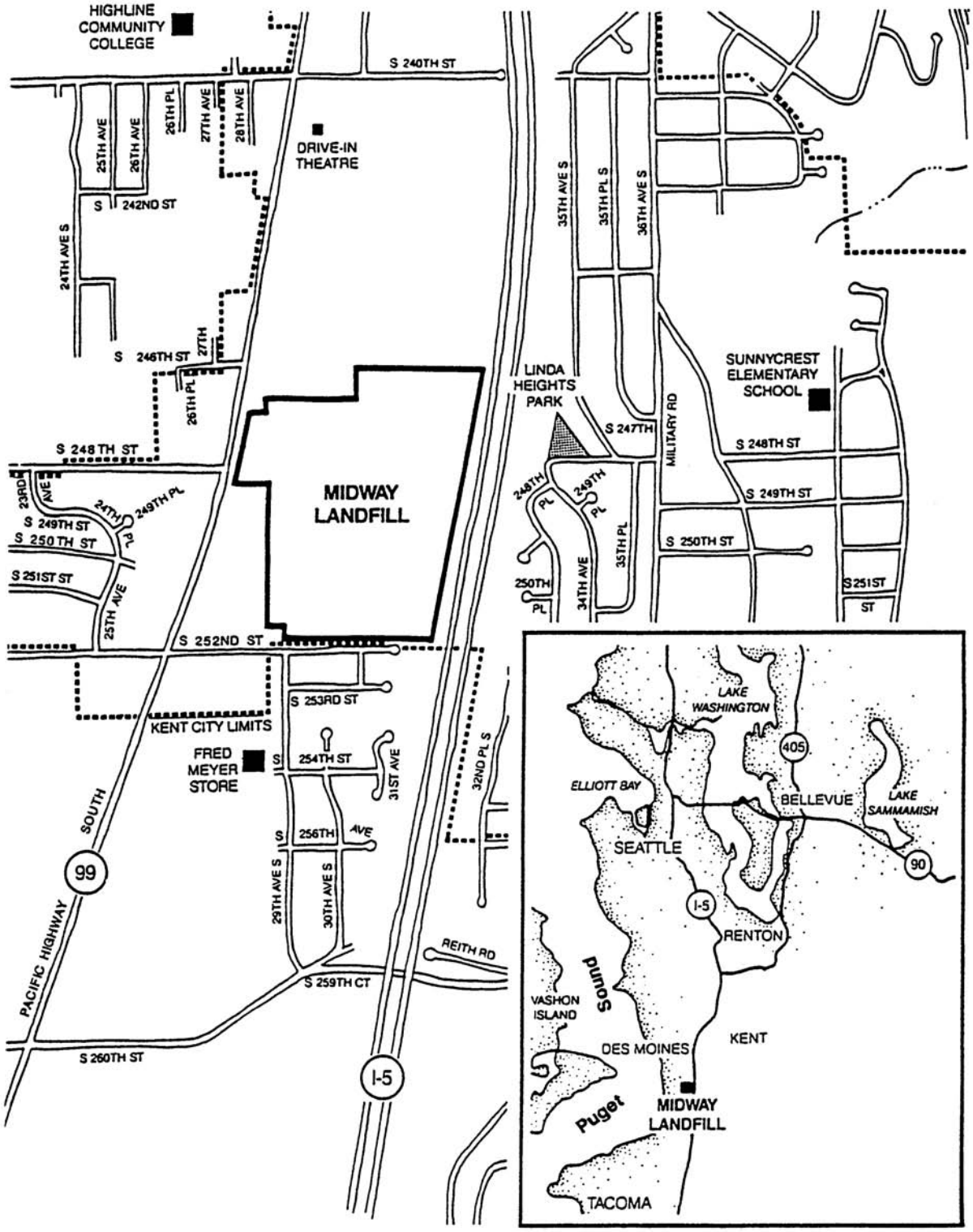
- Revise the Midway Landfill Operations and Maintenance Manual to include the current landfill gas sampling locations and schedule and location of operational gas extraction wells.

X. PROTECTIVENESS STATEMENT

Protectiveness deferred. A protectiveness determination of the remedy at the Midway Landfill cannot be made at this time until further information on 1,4 dioxane is obtained. Further information will be obtained by adding one well (MW-7B) to the monitoring network and adding 1,4 dioxane to be sampled in all monitoring wells. The City of Seattle has agreed to incorporate this additional well and contaminant to the monitoring network. It is expected that the protectiveness determination can be made after two rounds of sampling are completed, which is estimated to be available by September 2012.

XI. NEXT REVIEW

The next Five Year Review should occur within five years, by September 2015.



Parametrix Midway Landfill/555-1550-052/01(01A2)

SCALE IN FEET

0 50 100

N

Figure 1
Site Location Map
Midway Landfill
Kent, Washington

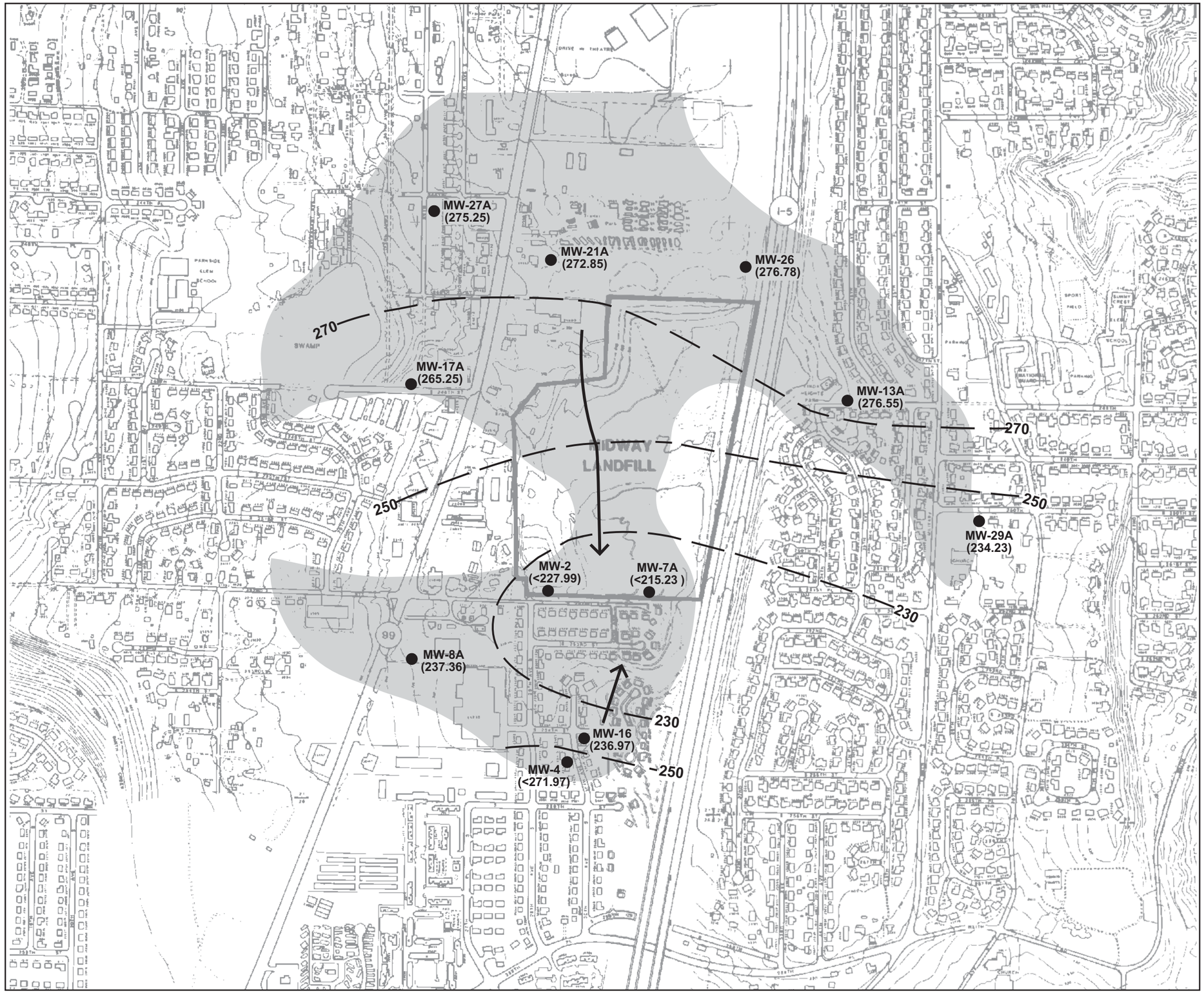


Figure 2
Generalized Upper Gravel Aquifer Potentiometeric Surface Map, October 2008
Midway Landfill
Kent, Washington

MW-7A ●	Upper Gravel Aquifer Monitoring Well Number and Approximate Location
—250—	Approximate Potentiometric Surface Contour (in feet)
(275.25)	Measured Groundwater Elevation in Feet October 27, 2008
←	General Direction of Groundwater Flow
(<215.23)	Well was Dry, Elevation is Elevation of Bottom of Well
	Inferred Extent of Upper Gravel Aquifer

Base Map Source: Supplemental Hydrogeologic and Hydrochemical Investigation, AGI 1990

N

0 300 600
Scale in Feet

Parametrix Midway Landfill/555-1550-054/01(01A2) 1/09 (B)

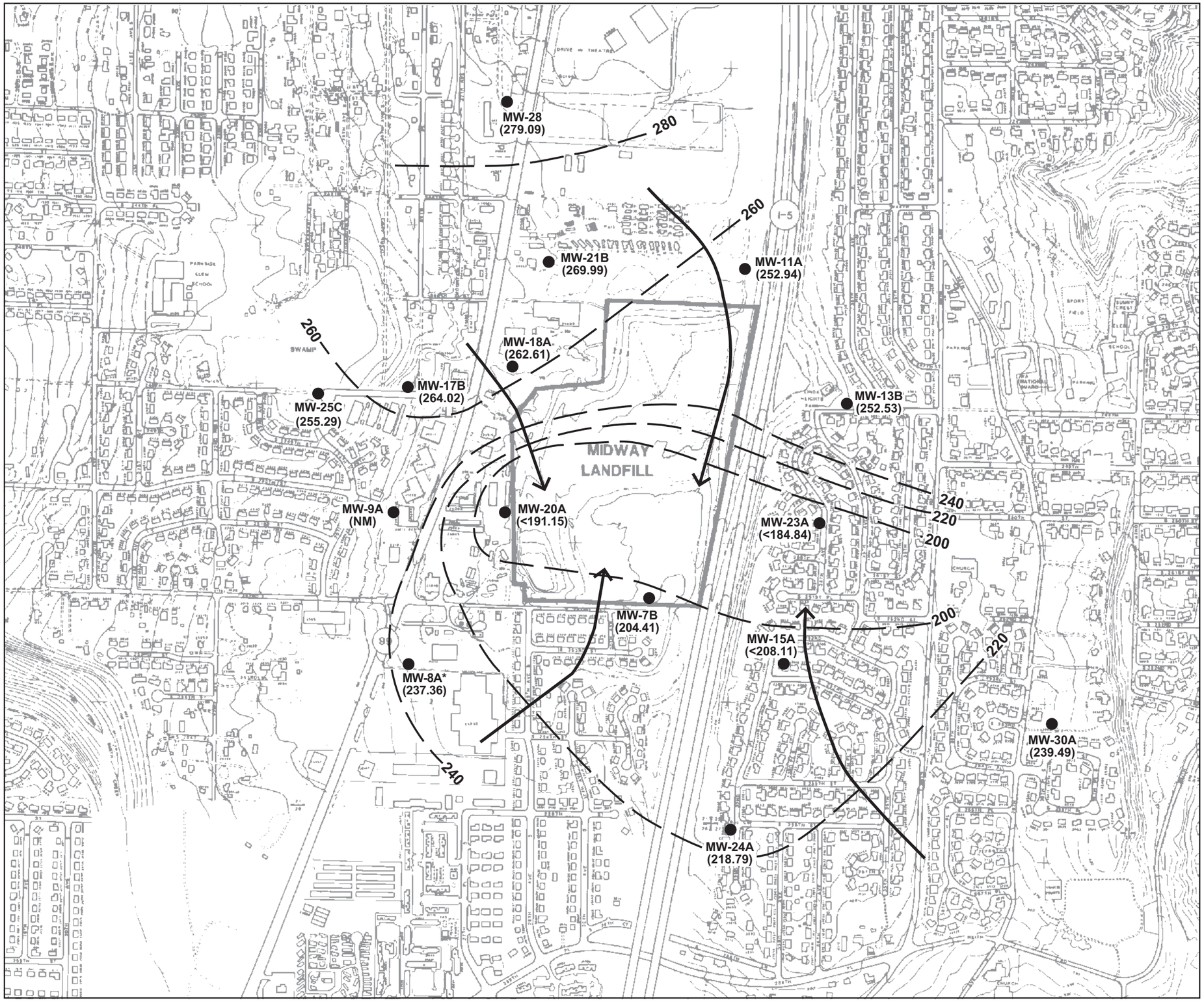


Figure 3
Generalized Sand Aquifer
Potentiometeric Surface Map, October 2008
Midway Landfill
Kent, Washington

MW-11A ●	Sand Aquifer Monitoring Well Number and Approximate Location
—220—	Approximate Potentiometric Surface Contour (in feet)
(279.09)	Measured Groundwater Elevation in Feet October 27, 2008
←	General Direction of Groundwater Flow
(<184.84)	Well was Dry, Elevation is Elevation of Bottom of Well
NM	Not Measured

* Although MW-8A is Used for Groundwater Chemistry Monitoring in the UGA, Water Elevations in this Well are Considered Representative of the SA

Base Map Source: Supplemental Hydrogeologic and Hydrochemical Investigation, AGI 1990

N

0 300 600
Scale in Feet

Parametrix Midway Landfill/555-1550-054/01(01A2) 1/09 (B)

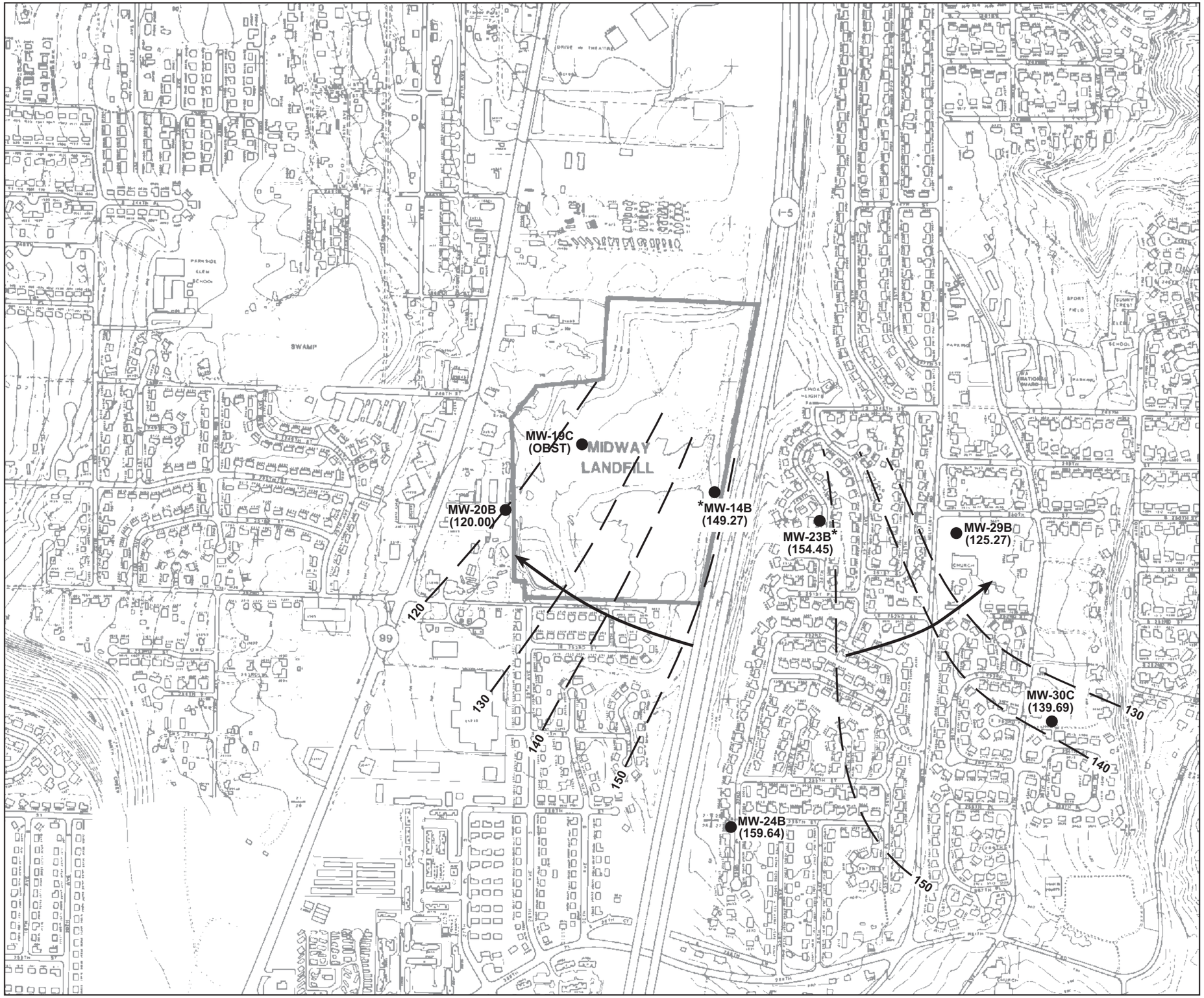


Figure 4
Generalized Southern Gravel Aquifer Potentiometric Surface Map October 2008
Midway Landfill
Kent, Washington

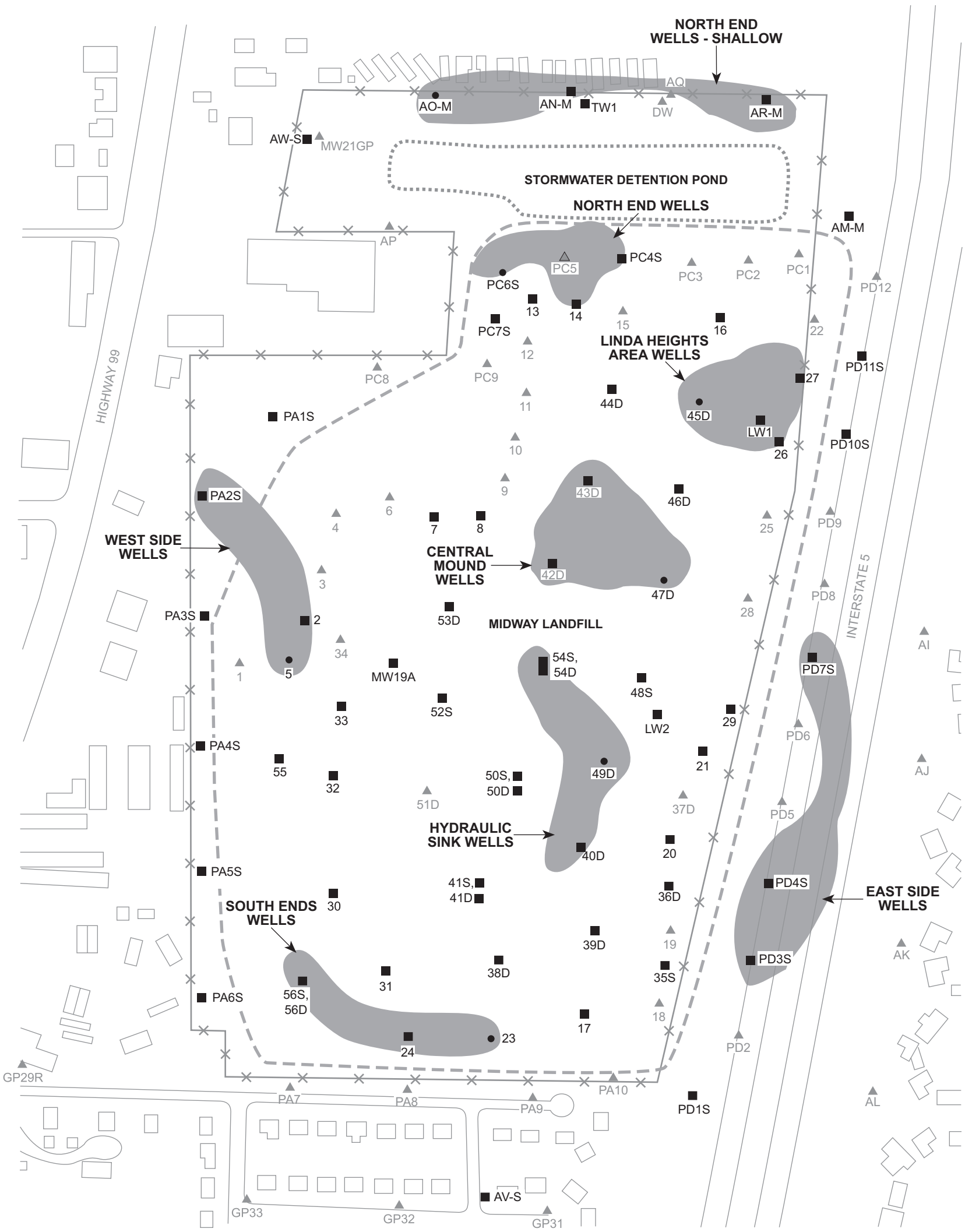
MW-14B ●	Southern Gravel Aquifer Monitoring Well Number and Approximate Location
—120—	Approximate Potentiometric Surface Contour (in feet)
(149.27)	Measured Groundwater Elevation in Feet October 27, 2008
←	General Direction of Groundwater Flow
OBST	Obstructed
*	Groundwater Level in These Wells Calculated Using Air Pressure Measurements at the Wellheads

Base Map Source: Supplemental Hydrogeologic and Hydrochemical Investigation, AGI 1990

N

0 300 600
Scale in Feet

Parametrix Midway Landfill/555-1550-054/01(01A2) 1/09 (B)



Base Map Source: City of Seattle Department of Engineering
Midway Landfill Vicinity Map, 5-15-86

Parametrix Midway Landfill Draft Monitoring Plan/555-1550-052/01(01A2)

23 — Gas probe, gas extraction well, or groundwater monitoring well number and location. Included in monitoring network. Monitoring frequency twice per year.

GP33 — Gas probe, gas extraction well, or groundwater monitoring well number and location. Not included in monitoring network.

17 — Gas probe, gas extration well, or groundwater monitoring well number and location. Included in monitoring network. Monitoring frequency once every other year.

Approximate limit of refuse

Fenced site boundary

SCALE IN FEET
0 125 250

N

Figure 5
Shallow Groundwater/ Saturated Refuse Fluid Level Monitoring Network
Midway Landfill
Kent, Washington

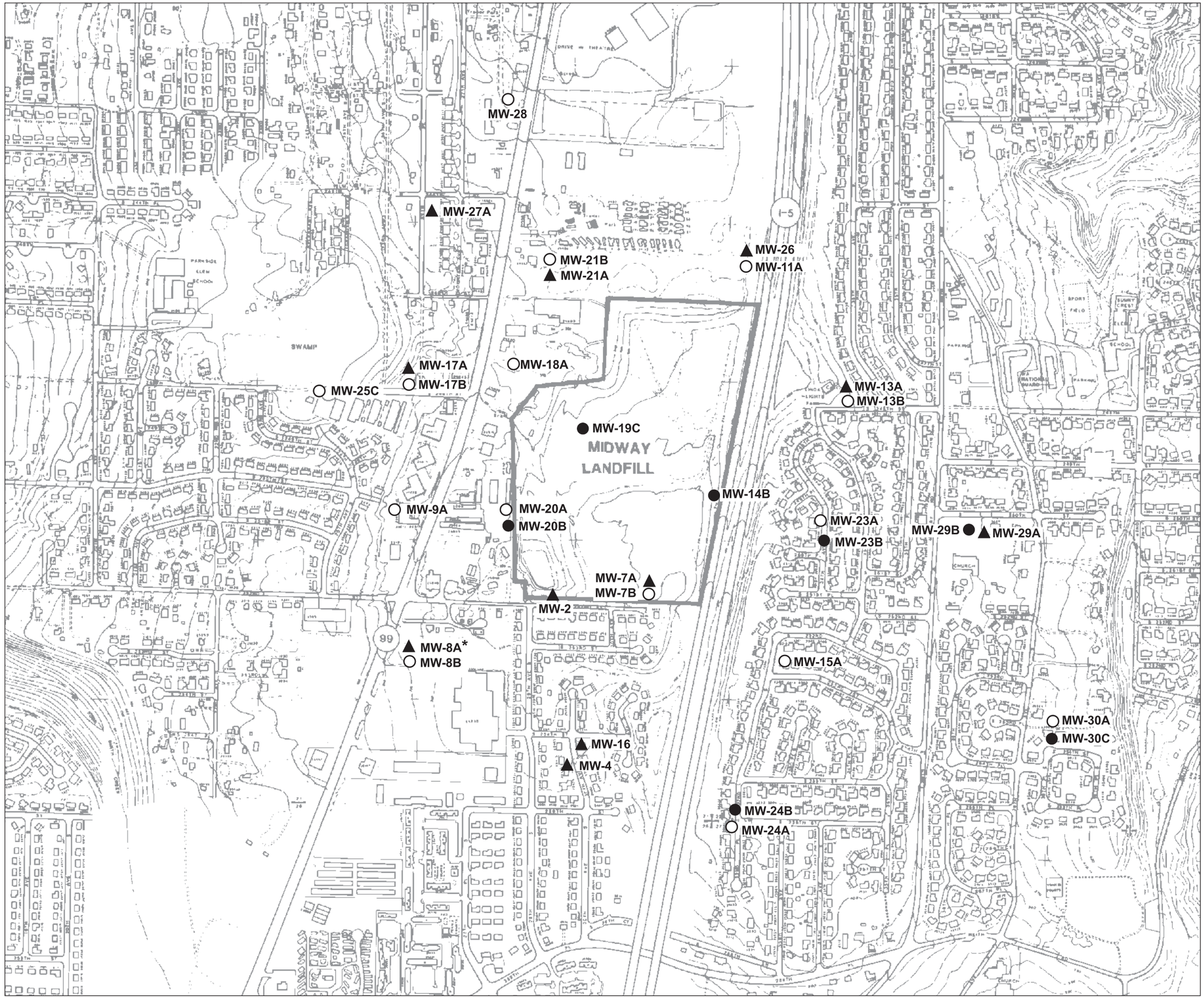


Figure 6
Upper Gravel Aquifer, Sand Aquifer and Southern Gravel Aquifer Groundwater Level Monitoring Network
Midway Landfill
Kent, Washington

▲ Upper Gravel Aquifer Monitoring Well

○ Sand Aquifer Monitoring Well

● Southern Gravel Aquifer Monitoring Well

* MW-8A is screened at the contact between the UGA and SA. Fluid levels in this well are considered representative of the UGA and the SA.

Base Map Source: Supplemental Hydrogeologic and Hydrochemical Investigation, AGI 1990

N

0 6

SCALE IN FEET

Parametrix Midway Landfill 555-1550-052/01(01A2) 7/07 (B)

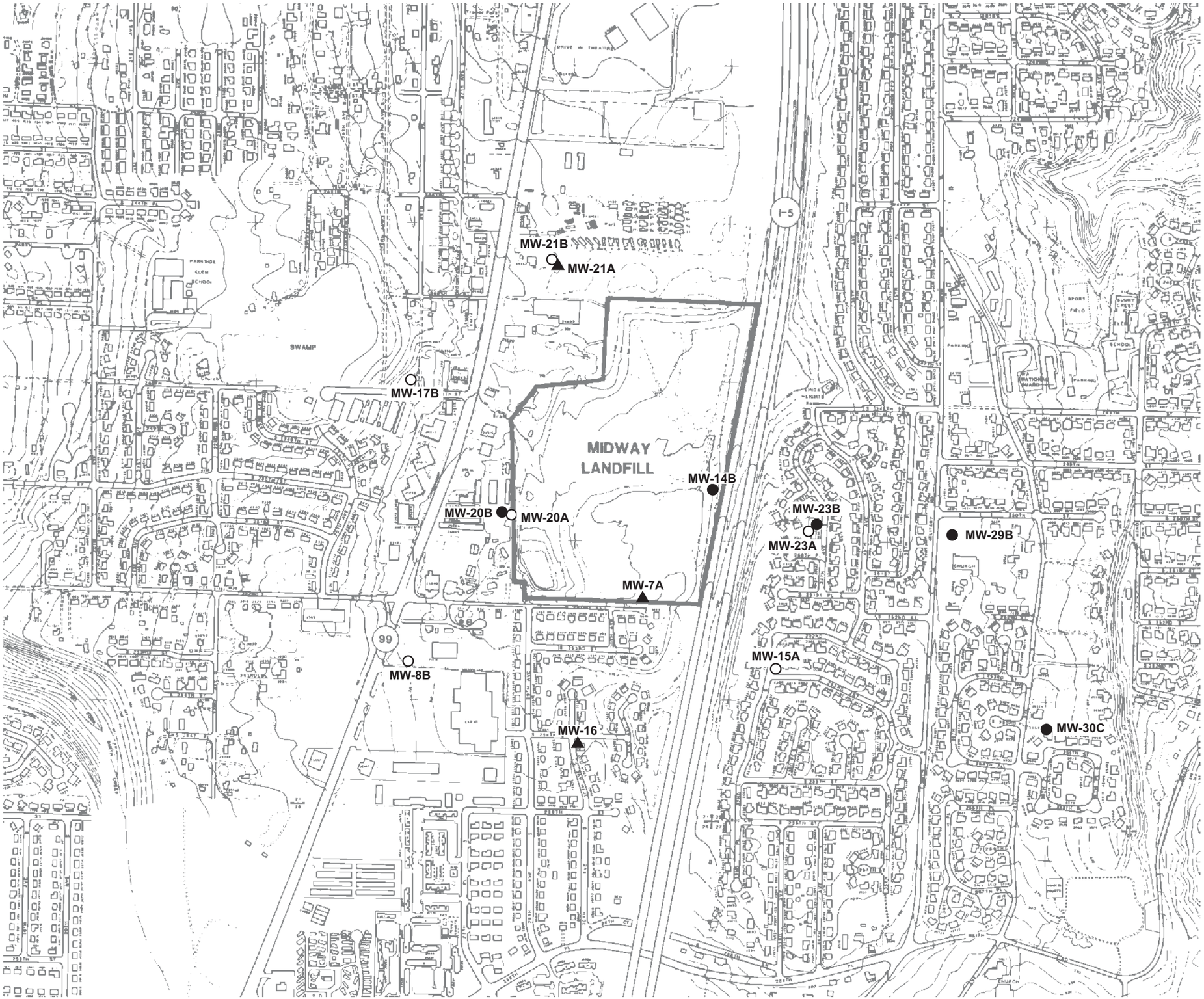


Figure 7
Well Locations for Groundwater Chemistry Monitoring
Midway Landfill
Kent, Washington

MW-16 ▲ Upper Gravel Aquifer Monitoring Well Number and Approximate Location

MW-17B ○ Sand Aquifer Monitoring Well Number and Approximate Location

MW-14B ● Southern Gravel Aquifer Monitoring Well Number and Approximate Location

Base Map Source: Supplemental Hydrogeologic and Hydrochemical Investigation, AGI 1990

0 600
SCALE IN FEET

N

Parametrix Midway Landfill/555-1550-052/01(01A2) 3/07 (B)

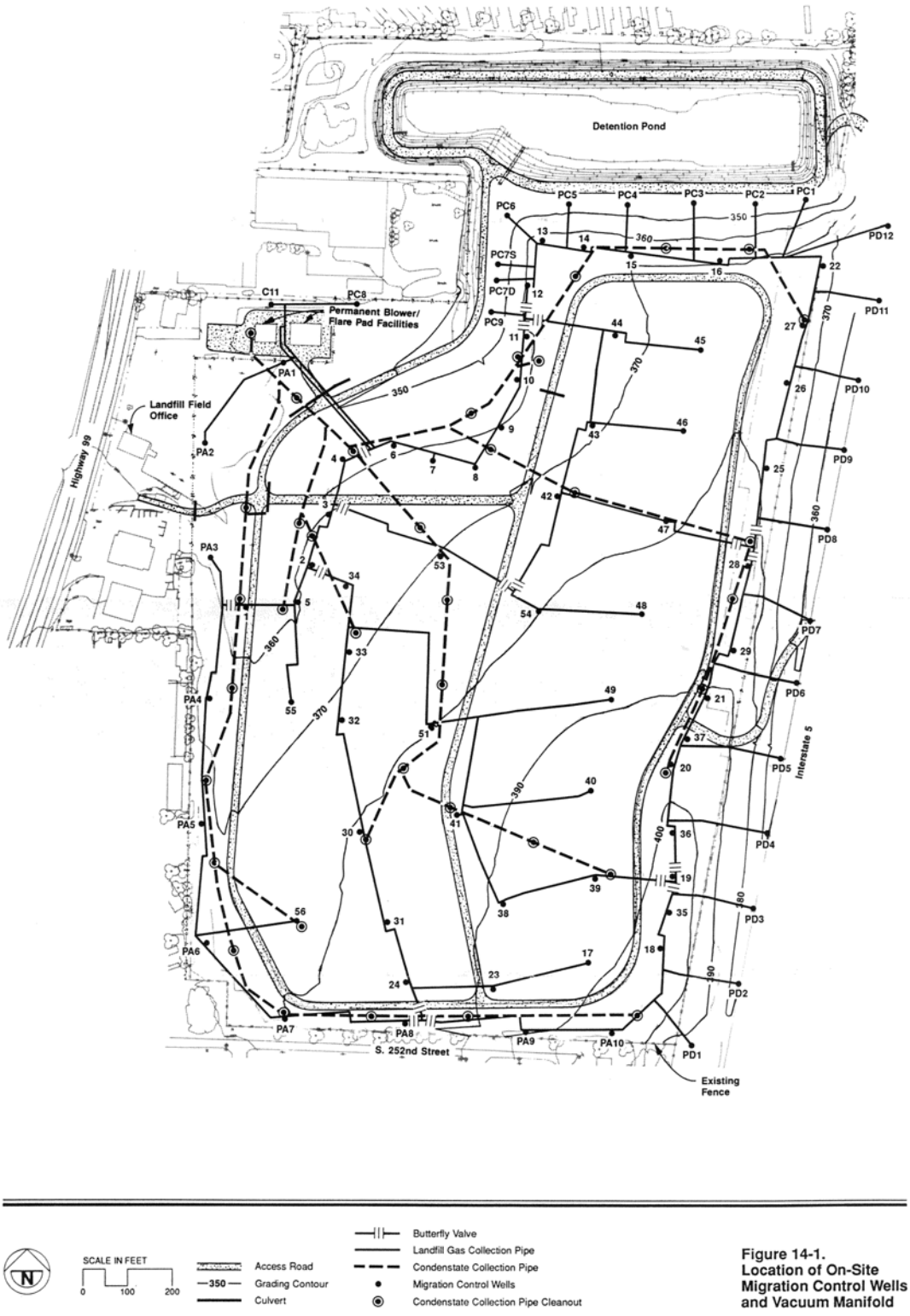


Figure 8. Gas Collection System

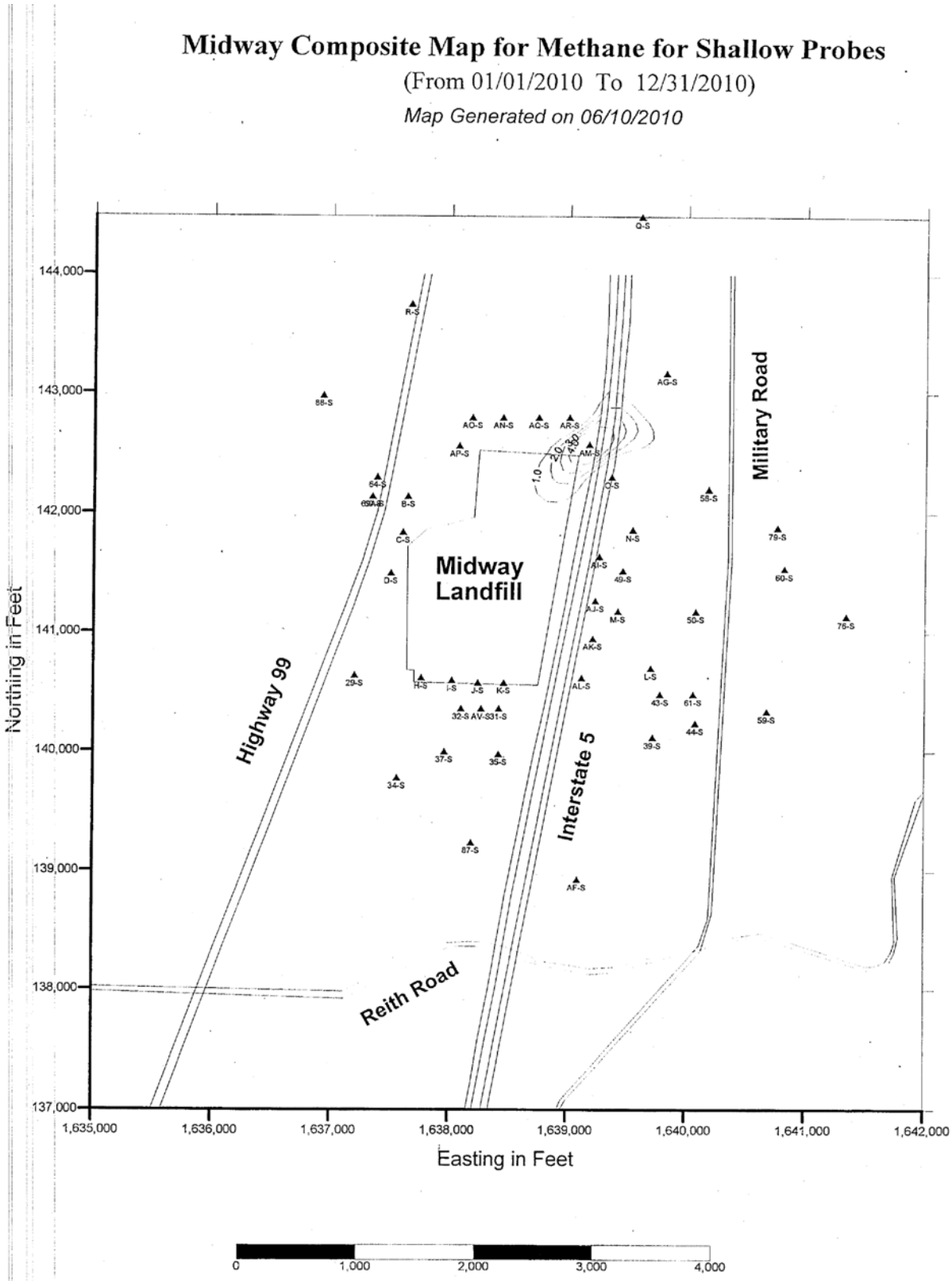


Figure 9. 2010 Methane Concentration in Shallow Gas Probes

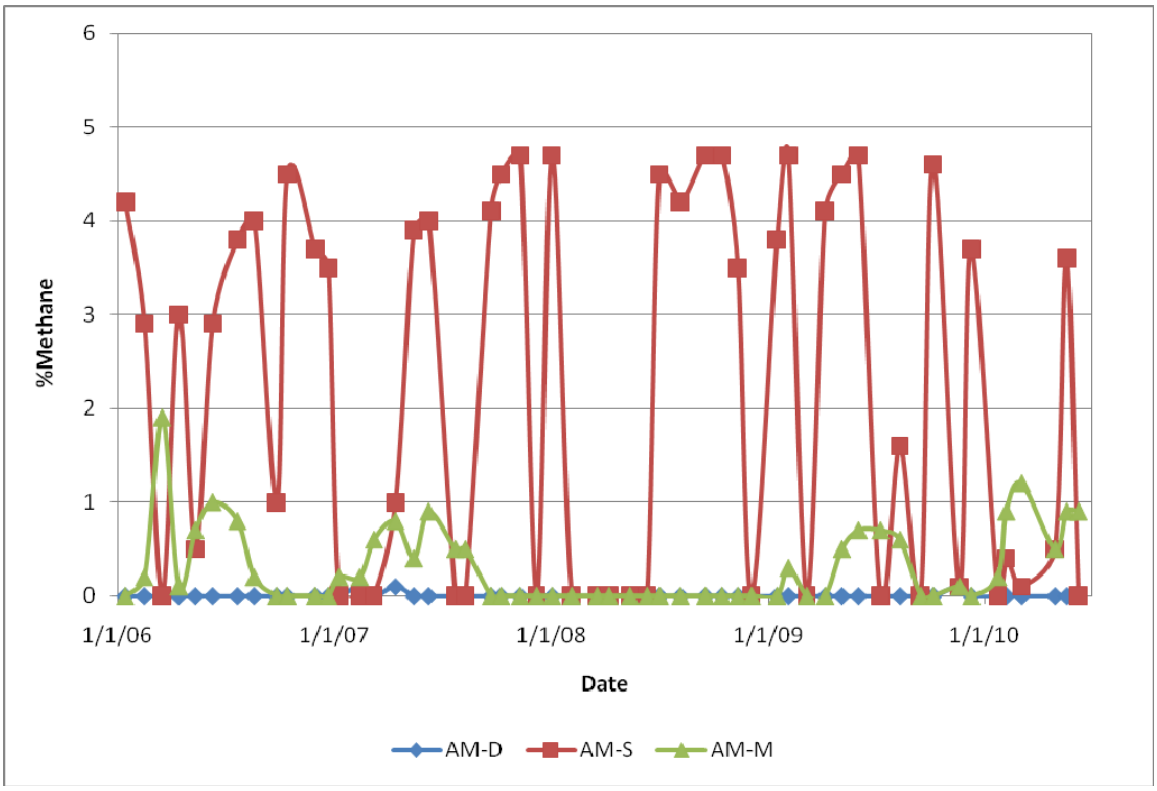


Figure 10. Percent Methane at Probe Location AM

Exhibit A.

City of Seattle

Gregory J. Nickels, Mayor

Seattle Public Utilities
Chuck Clarke, Director

Solid Waste Field Operations

April 14, 2005

[redacted]

Dear [redacted]:

RE: Status of Cleanup at the Midway Landfill Superfund Site in Kent, Washington.

I am pleased to provide this information regarding the status of cleanup activities at the Midway Landfill. I have also provided specific information with regard to your residence in the Midway vicinity. This information can be found on page 3 of this letter.

Background. The Midway Landfill, located about 15 miles south of Seattle within the City of Kent, was operated by the City of Seattle from 1966 through October 1, 1983. The site was used primarily for disposal of demolition debris, wood waste and yard waste, although there was also the disposal of some industrial wastes at the site.

Landfill Gas. In the summer of 1985 it was discovered that landfill gas had migrated away from the landfill through underground soils. As a result, about 140 gas probes were installed in the Midway vicinity. These probes, which allow us to monitor soil gas, showed that, although landfill gas was detectable on all sides of the site, the most significant migration had occurred to the east and south. Seattle also began a program of monitoring for homes and businesses in the Midway vicinity; at one time more than 300 homes were being monitored. Eleven families were evacuated from their homes between November 1985 and February 1986.

In response to the landfill gas problem, Seattle began the construction of a gas extraction system to prevent gas from leaving the site and to remove gas that had already migrated from the site. Construction of the first thirty wells at the site perimeter began in late 1985. Additional wells were constructed in the interior of the site and around the outside perimeter starting in late 1986.

Nineteen individual wells were also constructed in residential areas east of the site to remove off-site pockets of gas beginning in the spring of 1986. Gas from the on-site wells was burned off through two large temporary flares. Gas from off-site wells was vented to the air after passing through large carbon filters.

Key Tower Building, 700 5th Avenue, Suite 4900, Seattle, WA 98104-5004
Tel: (206) 684-5851, TTY/TDD: (206) 233-7241, Fax: (206) 684-4631, Internet Address: http://www.seattle.gov/util/
An equal employment opportunity, affirmative action employer. Accommodations for people with disabilities provided upon request.

The data indicate the gas extraction system was very effective in removing gas from soils in the Midway vicinity. The majority of shallow soils in the vicinity showed gas at or below background levels (200 to 400 ppm (parts per million)) by 1987. By August 1987, gas was no longer detectable in homes above the background level for ambient air (100 ppm). In fact, most homes showed 0 ppm of gas. Home monitoring was discontinued. Since that time we have continued to see significant improvements in the removal of gas from soils surrounding the site. At present, gas is above background levels in deeper levels (40 to 100 feet below ground surface) in only two off-site areas: about 1100 feet east of the southeastern side of the site and about 1000 feet east of the northeastern corner. Both areas are under the control of the gas extraction system. This means that the gas is under a vacuum and moving back towards the site rather than upwards. All of the nineteen off-site gas extraction wells have been shut down, and two are being used as gas probes. The gas pockets that these wells were constructed to evacuate have been eliminated.

Good Neighbor Program. In April 1986, Seattle established the "Good Neighbor Program" in response to citizen concerns about the value of their property. Through this program, the City guaranteed the fair market value of single family homes in a defined area around the landfill. The City agreed to maintain this program until at least 10 homes in the area had sold at fair market value or until two years after gas measured 100 ppm (0.01 percent) or less in nearby residences. The program ended in May 1988 when well over 10 homes had sold at or above fair market value. As stated above, gas in homes has been below 100 ppm since August 1987.

Participants in the program were required to actively list their homes for six months. If the City had not approved an offer on the home during that time period, the City then purchased the home at the agreed upon fair market value. During the course of the program, 349 homeowners participated, though 61 decided to drop out of the program. Of these residences, 122 sold within the six-month listing period with a City subsidy (to bring the total value up to the agreed upon fair market value), and the City purchased 166 homes. The homes purchased by the City were also listed and sold. By the end of 1988, only 22 homes remained to be sold. By December 1989, only one home remained, which was sold in 1990.

Superfund Status. In May 1986, the Midway Landfill was declared a federal "Superfund" site and listed on the National Priority List (NPL) for cleanup. As a result, Seattle conducted a detailed remedial investigation and feasibility study (RI/FS) under federal Superfund laws. Areas of investigation included geology and groundwater, surface water, seeps and soils; ambient air quality; and landfill gas. The RI was completed in September 1988.

Landfill gas was remediated by the measures described above. In regards to groundwater, the contamination extends up to about 2500 feet east/southeast of the site and about 1000 feet west at very deep levels (generally 300 to 400 feet below the ground surface). However, the contamination is at low levels (just above federal drinking water standards). No drinking water aquifers are affected by this contamination and no one comes into contact with this water. Residents in the vicinity get their water from a public supply system whose wells are several miles from the site.

The second part of the Superfund study, the Feasibility Study (FS), was completed in December 1990. The FS evaluated alternatives for cleanup of any existing or future contamination at the site. At this point in time, we are in the process of negotiating a "Cleanup Action Plan" (CAP) with the State Department of Ecology, which formalizes our cleanup/closure actions at Midway. The CAP is expected to be completed by the end of the year.

Remedial Actions. Thus far the following remedial actions have been completed at the site:

- Midway Landfill Temporary Landfill Gas Extraction System Construction

- Midway Landfill Onsite Grading and Drainage Construction (including the detention pond)
- Midway Landfill Permanent Flare Facility Construction
- Midway Landfill Downstream Drainage Improvement Project (surface water discharge pipeline to McSorley Creek and associated drainage improvements along Pacific Highway So.)
- Midway Landfill Upstream Drainage Improvement Project (I-5 pump station and associated stormwater conveyance pipeline to the Midway detention pond)
- Midway Landfill Final Cover and Permanent Gas Extraction System Project (including landfill capping and permanent gas system construction)

Specific Information. In an e-mail request to Jeff Neuner, specific information regarding the property delineated by shading on the enclosed map was requested. Enclosed are copies of the 2003/2004 monitoring data for the gas probes nearest this property. The data shows that the landfill gas in the soil zones near the property (Probe AO, probe AN, probe AQ, probe AR, and probe AW) is at zero parts per million.

The gas levels in the intermediate and deep levels of the probes also show no presence of landfill gas.

Levels of landfill gas in the vicinity of this property were never found to be above background levels. For that reason, off-site gas extraction wells were not located there. Also, no groundwater contamination has been found in this area as shown by the enclosed 2004 data for groundwater monitoring well MW-21. An extensive compilation of gas and groundwater data may be obtained at the Kent Public Library, in their public repository. These data are contained in the Remedial Investigation and Feasability Study Reports on the Midway Landfill. For more current information, you may call me at 684-7693.

The landfill gas extraction system at the Midway Landfill has been doing an excellent job of drawing off the combustible gas and harmlessly flaring it. Thus gas is no longer leaving the site. In addition, the amount of gas generated within the landfill has decreased dramatically over the last ten years. For these reasons, little gas has been detected in the surrounding neighborhoods for years. As a result, some of the gas probes that were used early in the program to establish the extent of the gas are no longer monitored because no gas has been detected in them. Because of this fact, the State Department of Ecology approved the removal of several of these old probes years ago. State law requires that abandoned wells/probes must be drilled out and sealed in a specific way, and that is the task that the City is undertaking at this time. Many probes remain in place to monitor the situation such as the two noted above. These will be monitored and studied for the foreseeable future.

The information provided in this letter, other than the gas monitoring and groundwater monitoring data, summarizes an extensive history relating to the closure of the Midway Landfill. Since this information is only general in nature, the City of Seattle does not intend that anyone reading this letter will rely solely on this information in forming a decision to purchase or finance real property. If you are concerned about the effect of the landfill closure on property values in the area of the Midway Landfill, you should contact a qualified appraiser or environmental consultant or independently review the scientific studies and other reports relating to the landfill. Further, this letter should not be construed or relied on by anyone as an endorsement or recommendation to invest, purchase or finance real property.

I hope that this information has been helpful. Please contact me at 206-684-7690 if you have any questions.

Sincerely,

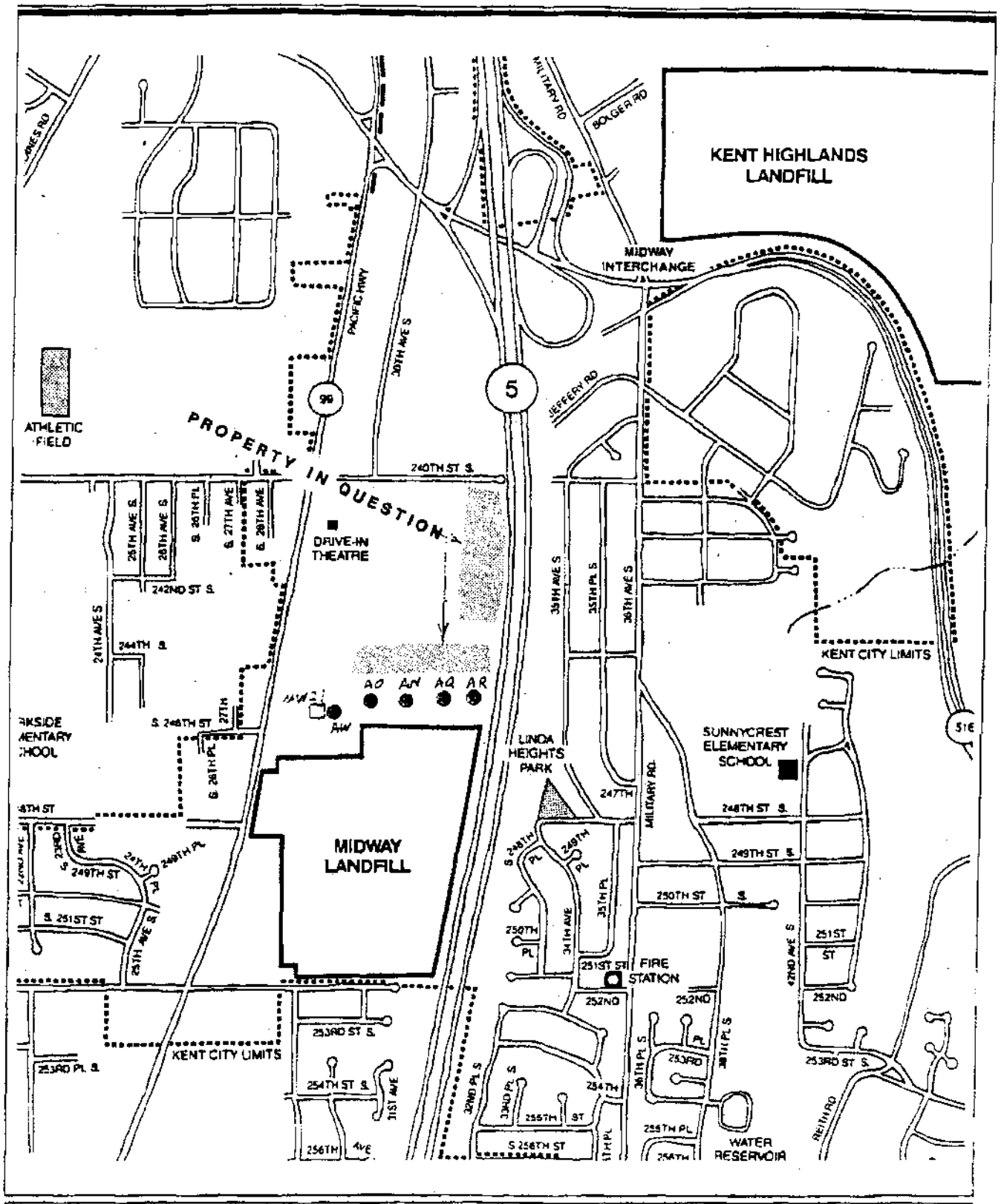
Philip R. Woodhouse //FOR//

Jeff Neuner
Landfill Manager

JHN/prw

Enclosures

cc: Sean McDonald
Jeff Neuner
Marya Silvernale
Midway Files



SCALE IN FEET

0 1,000 2,000

N

April 14, 2005

Figure I-2.
Midway Landfill vicinity map.

10205975

Table 3-2. Comparison of Contaminants of Concern in Groundwater to ROD Cleanup Levels

Analyte	Units	Clean up Level[a]	Round ID	Upper Gravel Aquifer[b]				Sand Aquifer[c]								Southern Gravel Aquifer													
				MW-16		MW-21A		MW-8B		MW-17B		MW-21B		MW-21B (DUP)		MW-14B		MW-14B (DUP)		MW-20B		MW-23B		MW-29B		MW-29B (DUP)		MW-30C		MW-30C (DUP)	
				UP		UP		UP		UP		UP		UP		DOWN		DOWN		DOWN		DOWN		DOWN		DOWN		CROSS		CROSS	
Manganese	mg/L	2.2	R-53	0.109		0.029		0.046		0.077		0.436				1.04		1.05		4.28		0.186		1.09				0.662		0.651	
			R-54							0.070		0.454		0.450		1.12				3.68		0.168		1.03		1.06		0.651			
1,2-Dichloroethane	µg/L	5	R-53	1.0	U	1.0	U	1.0	U	6.3						1.0	U	1.0	U	1.0	U	3.4		5.7				1.0	U	1.0	U
			R-54							5.3		1.0	U	1.0	U	1.0	U			1.0	U	3.2		5.4		5.1		1.0	U		
Vinyl Chloride	µg/L	0.29*	R-53	0.20	U	0.20	U	0.20	U	0.31		0.20	U			0.58		0.58		0.26		0.40		0.89				0.20	U	0.20	U
			R-54							0.24		0.20	U	0.20	U	0.55				0.23		0.38		0.83		0.97		0.26			

ROD= Record of decision
R-53= Round 53, May 2008
R-54= Round 54, November 2008
a = Clean up levels established in the Final EPA Record of Decision for the Midway Landfill Site, September 6, 2000.
b = Downgradient well MW-7A not sampled due to the wells being dry or insufficient water for sample collection.
c = Downgradient wells MW-15A, MW-20A, and MW-23A not sampled due to the wells being dry or insufficient water for sample collection.

[ ] = Exceeds cleanup level established in the Final EPA Record of Decision for the Midway Landfill, September 6, 2000.
U = Indicates the compound was undetected at the reported concentration
DUP= Duplicate.
* The revised cleanup level for vinyl chloride is 0.29 µg/L, using the MTCA adjusted cancer risk of 1^{e-5}.
Notes: Up, Down, or Cross in column title denotes whether the well is located upgradient, downgradient, or cross-gradient of the landfill's influence.

Table 3-3. Summary of Detected Groundwater Quality Parameters Not Included in the ROD and Comparison to Regulatory Standards

					Upper Gravel Aquifer[c]				Sand Aquifer[d]								Southern Gravel Aquifer															
					MW-16		MW-21A		MW-8B		MW-17B		MW-21B		MW-21B (DUP)		MW-14B		MW-14B (DUP)		MW-20B		MW-23B		MW-29B		MW-29B (DUP)		MW-30C		MW-30C (DUP)	
Analyte	Units	MCL[a]	MTCA B[b]	Round ID	UP		UP		UP		UP		UP		UP		DOWN		DOWN		DOWN		DOWN		DOWN		DOWN		CROSS		CROSS	
Field Parameters																																
pH		6.5-8.5*		R-53	7.92		6.91		7.70		6.86		7.08				6.67				6.85		6.58		6.63				7.28			
				R-54							6.84		7.02				6.65				6.85		6.46		6.57				7.12			
Specific Conductivity	µmhos/cm			R-53	280		355		212		412		721				766				1530		629		757				310			
				R-54							375		718				763				1468		615		749				312			
Temperature	C			R-53	12.0		11.6		11.0		11.5		10.9				13.2				11.0		12.0		10.6				10.5			
				R-54							11.4		11.0				13.2				10.8		11.2		10.2				9.8			
Conventional Parameters																																
Chloride	mg/L	250**		R-53	8.6		7.3		6.8		12.3		16.7				20.5		20.4		64.4		14.6		40				12.6		12.6	
				R-54							11.1		16.6		16.5		20.9				55.8		14.8		34.8		35.3					
COD	mg/L			R-53	5	U	5	U	5	U	5.0	U	5	U			7.60		6.62		21.0		5.31		5.97				5	U	5	U
				R-54							5	U	5	U	5	U	11.2				20.5		5.45		6.41		11.5					
Sulfate	mg/L	250**		R-53	25.2		41		26.8		24.8		125				25.0		24.9		17.0		28.9		19.6				11.5		11.5	
				R-54							23.4		119		113		26.1				17.1		28.8		18.5		18.3					
TOC	mg/L			R-53	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U			2.04		2.37		216		1.79		2.70				1.5	U	1.5	U
				R-54							1.5	U	1.5	U	1.74		2.55				7.97		1.5	U	2.40		2.11					
Dissolved Metals																																
Iron	mg/L	0.3**		R-53	0.28		0.05	U	0.05	U	0.05	U	0.05	U			11.8		11.9		11.4		9.78		15.2				2.41		2.32	
				R-54							0.05	U	0.05	U	0.05	U	13.1				10.6		9.57		15.1		15.6		2.39			
Volatile Organics																																
1,1,1-TCA	µg/L	200*	7200	R-53	1	U	1	U	1	U	1	U	5.6				1	U	1	U	1	U	1	U	1	U			1	U	1	U
				R-54							1	U	5		5		1	U			1	U	1	U	1	U	1	U	1	U		
1,1-DCA	µg/L		800	R-53	1	U	1	U	1	U	59		5.0				1.6		1.6		1	U	1	U	1				1	U	1	U
				R-54							43		4.4		4.3		1.5				1	U	1	U	1	U	1	U	1	U		
1,1-DCE	µg/L	7*	0.0729	R-53	1	U	1	U	1	U	3.5		4.2				1	U	1	U	1	U	1	U	1	U			1	U	1	U
				R-54							3.3		4.5		4.4		1	U			1	U	1	U	1	U	1	U	1	U		
cis-1,2 DCE	µg/L	70*	80	R-53	1	U	1	U	1	U	4.5		1	U			4.5		4.8		1	U	4.5		1.1				1	U	1	U

Analyte	Units	MCL[a]	MTCA B[b]	Round ID	Upper Gravel Aquifer[c]				Sand Aquifer[d]								Southern Gravel Aquifer															
					MW-16		MW-21A		MW-8B		MW-17B		MW-21B		MW-21B (DUP)		MW-14B		MW-14B (DUP)		MW-20B		MW-23B		MW-29B		MW-29B (DUP)		MW-30C		MW-30C (DUP)	
					UP		UP		UP		UP		UP		UP		DOWN		DOWN		DOWN		DOWN		DOWN		DOWN		CROSS		CROSS	
				R-54							4.1		1	U	1	U	4.6				1	U	4.0		1	U	1	U	1	U		
Volatile Organics (continued)																																
Chloroethane	µg/L			R-53	1	U	1	U	1	U	2.2		1	U			1	U	1	U	1	U	1	U	1	U			1	U	1	U
				R-54							2.2		1	U	1	U	1	U		U	1	U	1	U	1	U	1	U	1	U		
PCE	µg/L	5*	0.858	R-53	1	U	1	U	1	U	1	U	130				1	U	1	U	1	U	1	U	1	U			1	U	1	U
				R-54							1	U	140		140		1	U		U	1	U	1	U	1	U	1	U	1	U		
TCE	µg/L	5*	3.98	R-53	1	U	1	U	1	U	1	U	5				1	U	1	U	1	U	1	U	1	U			1	U	1	U
				R-54							1	U	4.8		4.8		1	U		U	1	U	1	U	1	U	1	U	1	U		
Trichlorofluoro -methane	µg/L		2400	R-53	1	U	2.7		1	U	1	U	5.5				1	U	1	U	1	U	1	U	1	U			1	U	1	U
				R-54							1	U	5.7		5.9		1	U		U	1	U	1	U	1	U	1	U	1	U		
SemiVolatile Organics																																
1,4 Dioxane***	µg/L		7.95	R-53							2.8		5.5				14		15													
				R-54							3.5		7.0		8.0		22															

R-53= Round 53, May 2008

R-54= Round 54, November 2008

☐ = Exceeds Federal MCL or MTCA Method B Groundwater Cleanup Level.

* = Primary MCL Standards; EPA National Primary Drinking Water Regulations (40 CFR 141 59 FR 34322).

** = Secondary MCL Standards; EPA National Primary Drinking Water Regulations (40 CFR 141 59 FR 34322).

*** = Testing for 1,4-Dioxane in selected groundwater samples was recommended by Ecology and EPA.

[a] = MCL/Federal maximum contaminant level.

[b] = MTCA B/Model Toxics Control Act (WAC 173-340) Method B Cleanup Level. CLARC II Database, Ecology, February 1996.

[c] = Downgradient well MW-7A not sampled due to the wells being dry or insufficient water for sample collection.

[d] = Downgradient wells MW-15A, MW-20A, and MW-23A not sampled due to the wells being dry or insufficient water for sample collection.

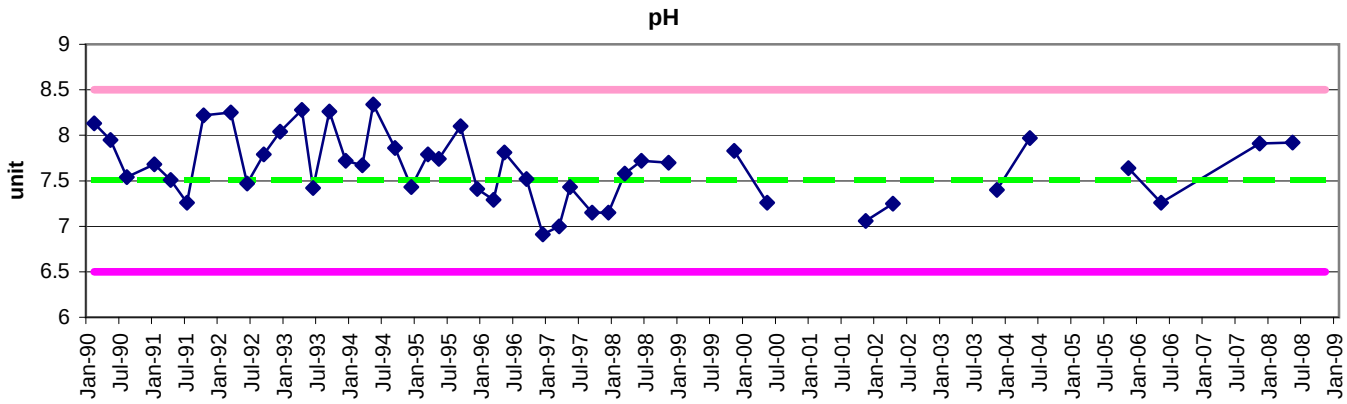
U = Indicates the compound was undetected at the reported concentration.

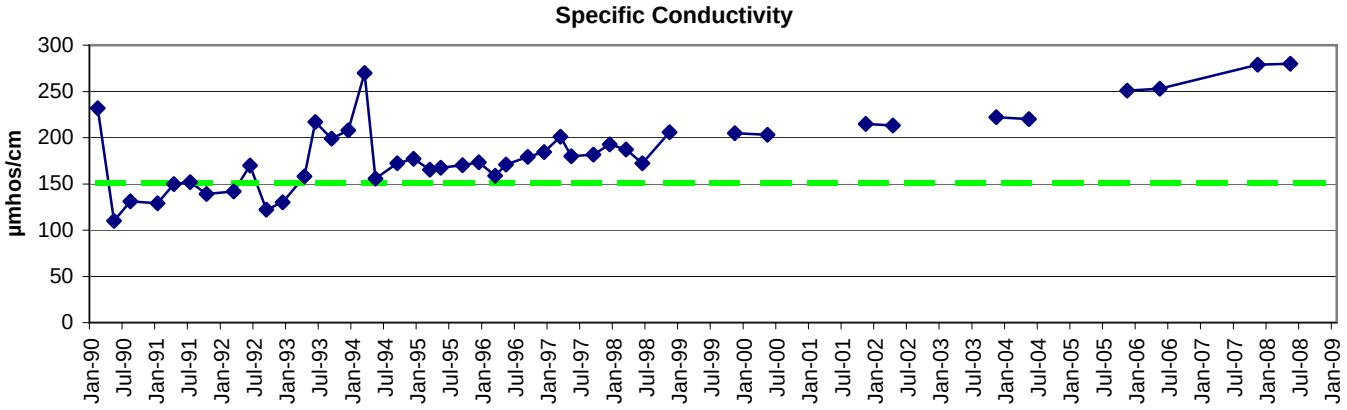
DUP= Duplicate.

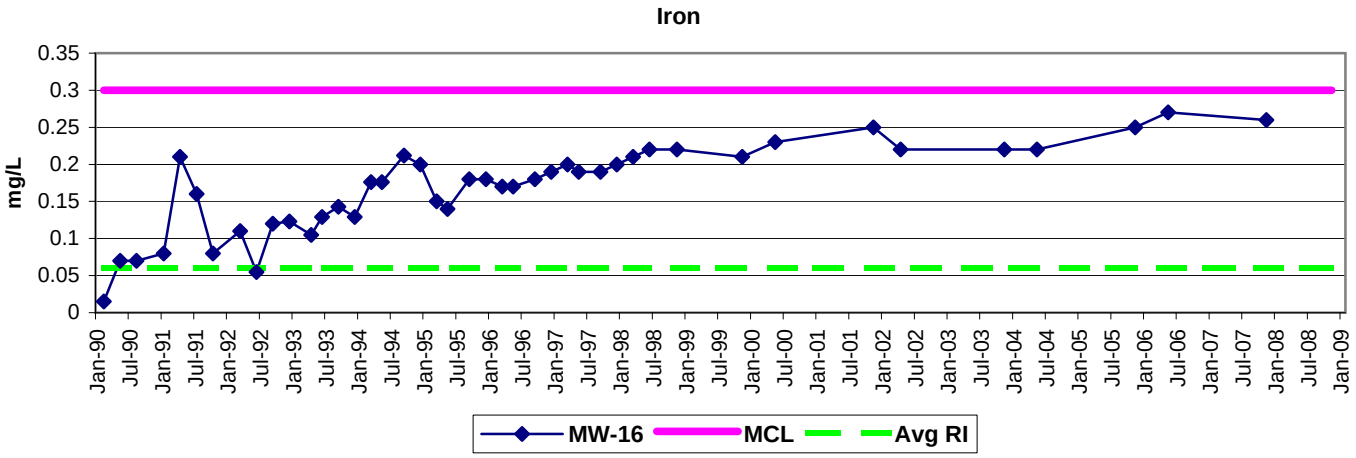
Note: Up, Down, or Cross in column title denotes whether the well is located upgradient, downgradient, or cross-gradient of the landfill's influence.

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Upper Gravel Aquifer Well
MW-16



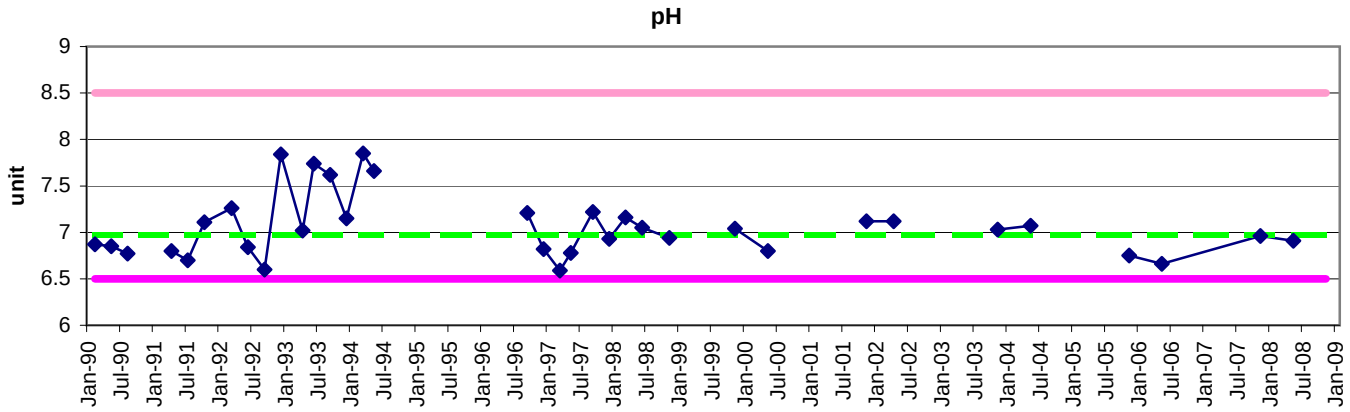


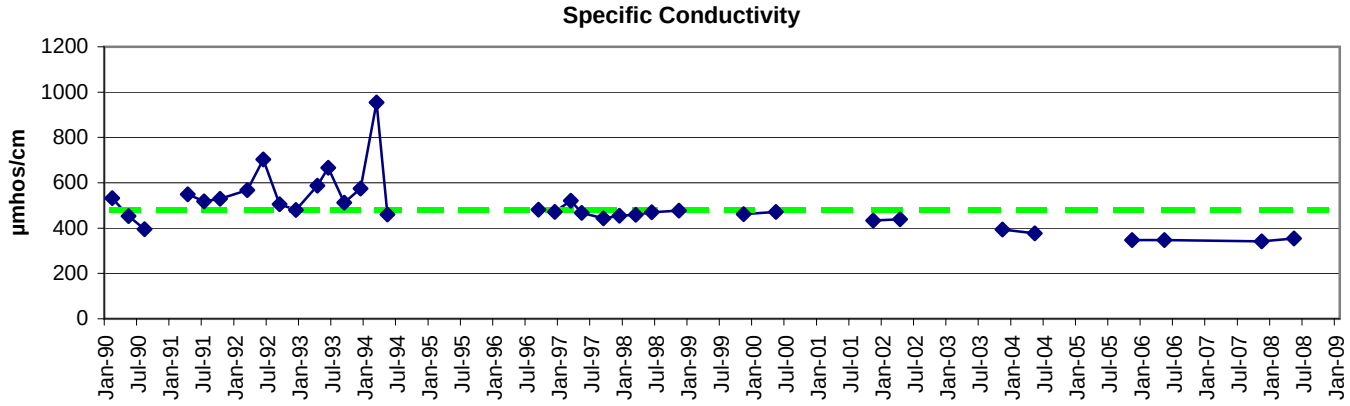


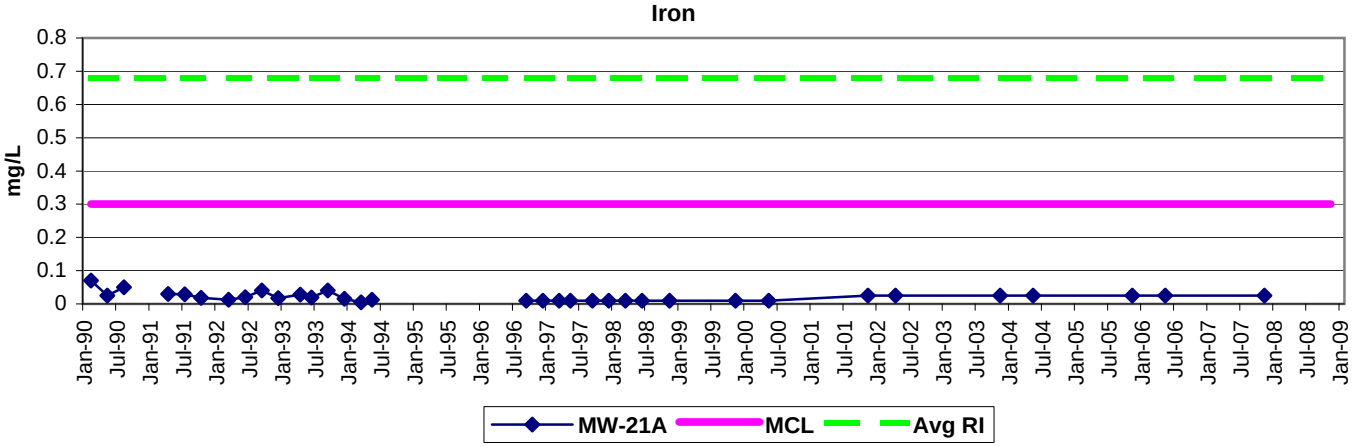
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Upper Gravel Aquifer Well
MW-21A



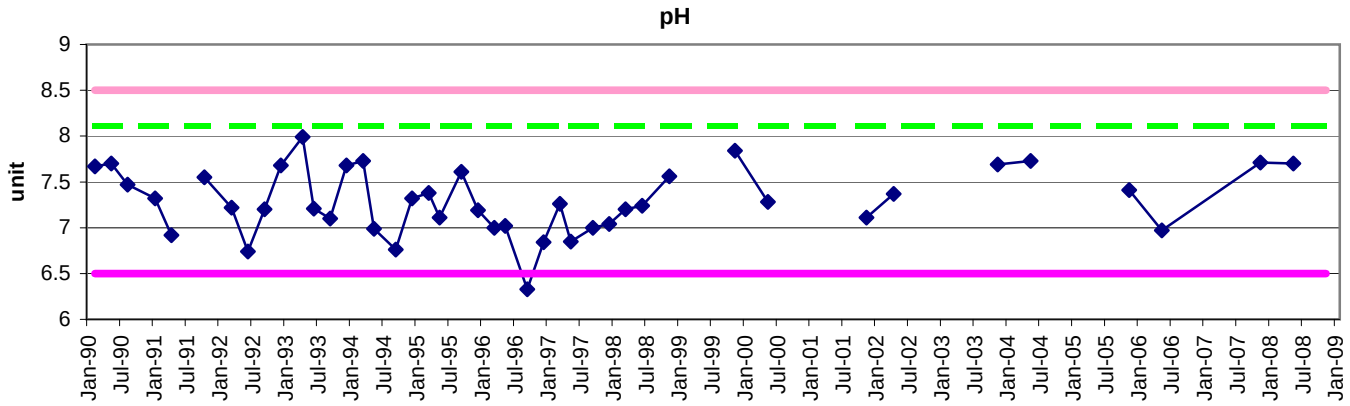


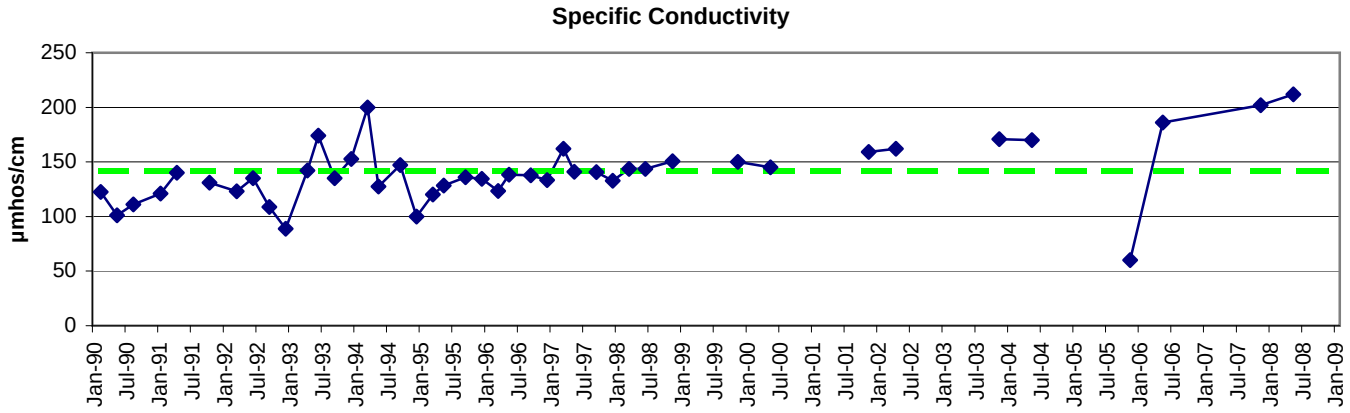


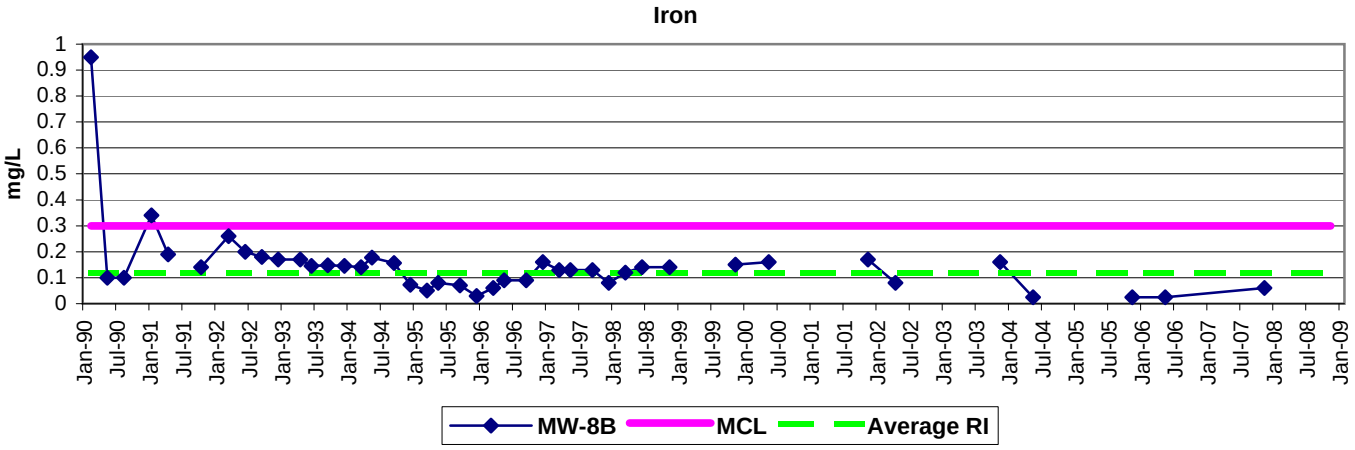
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-8B



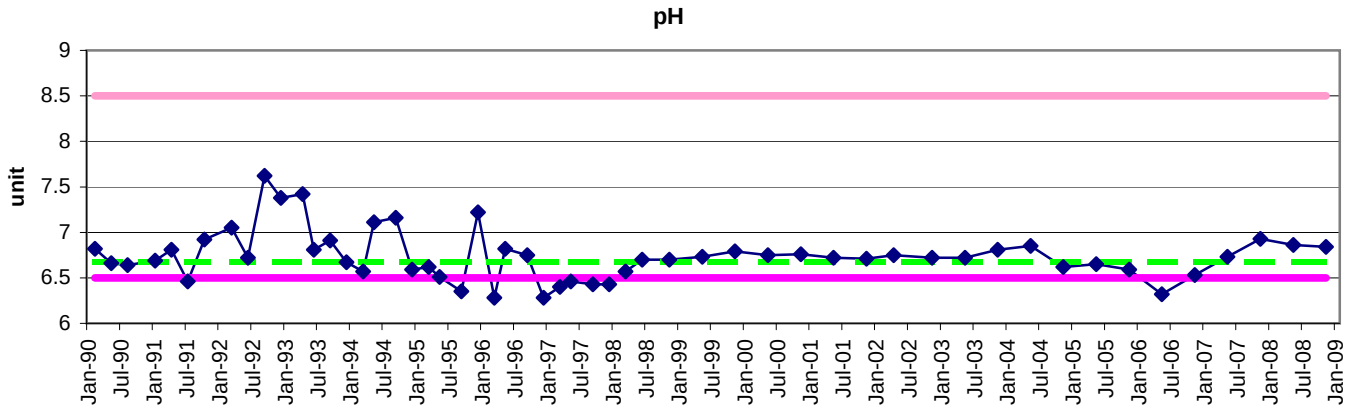


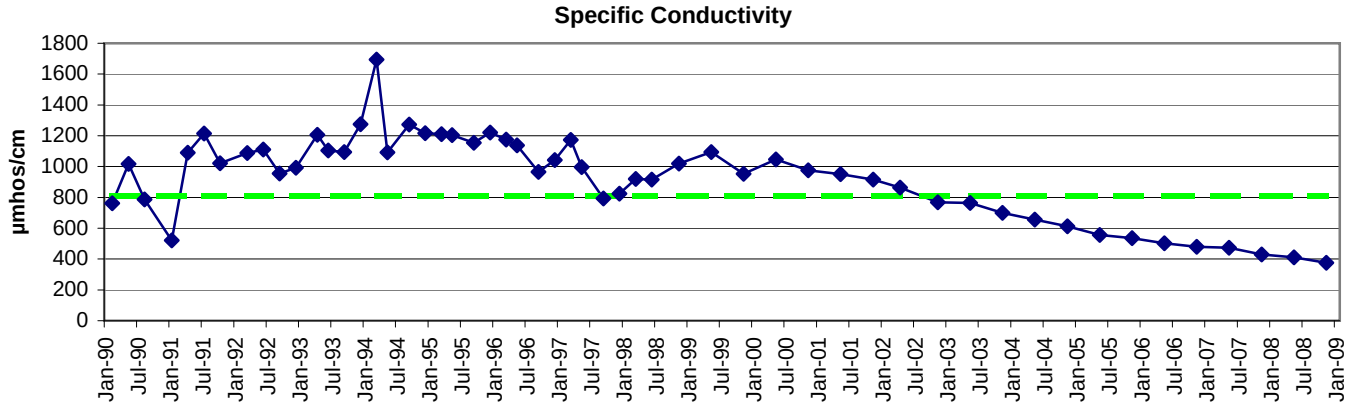


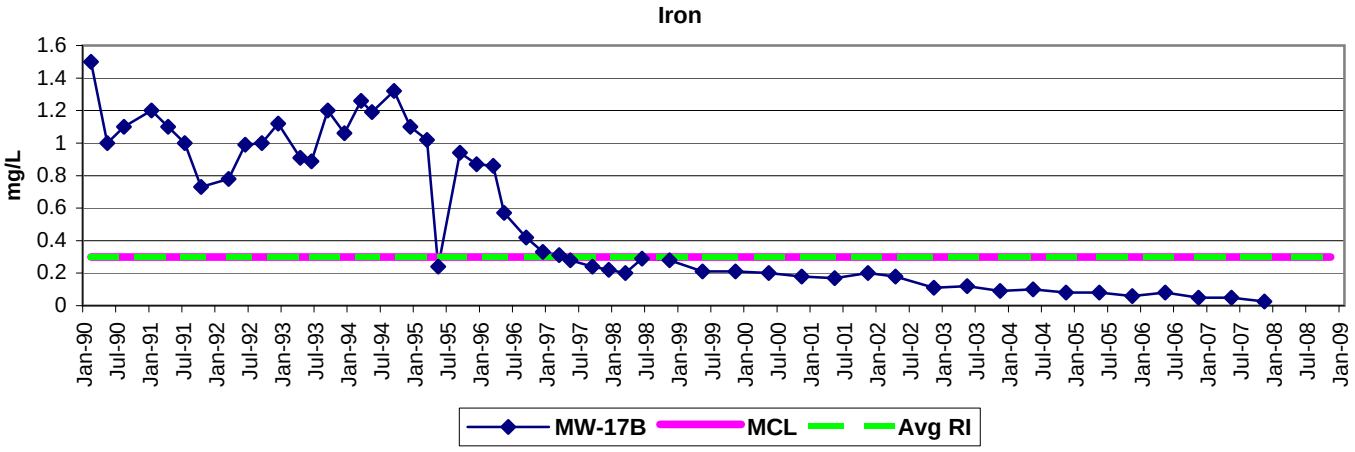
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-17B



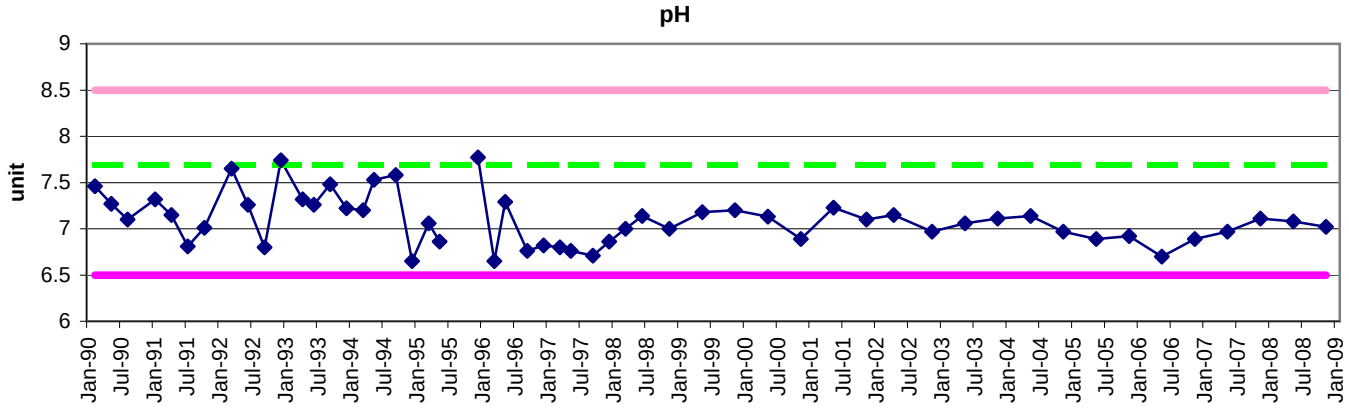


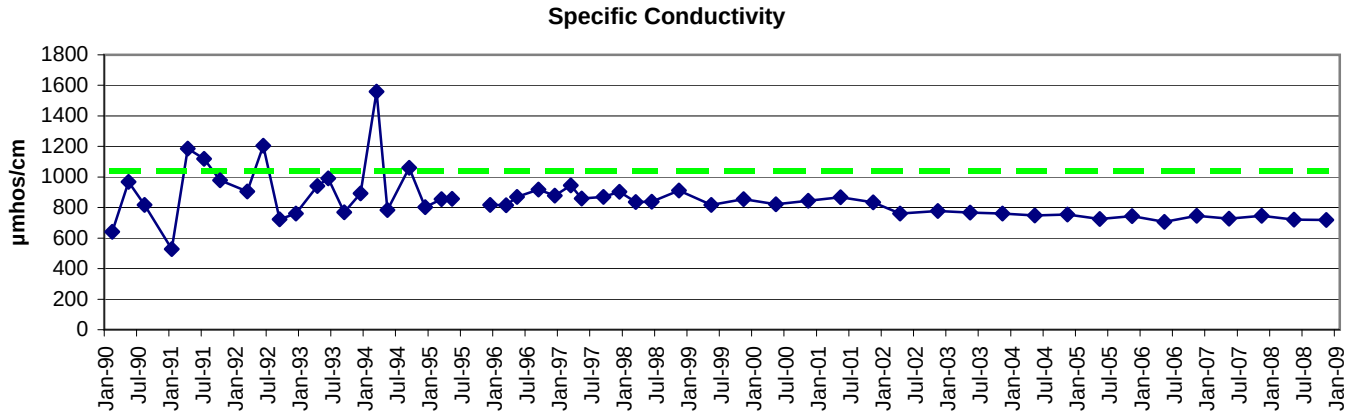


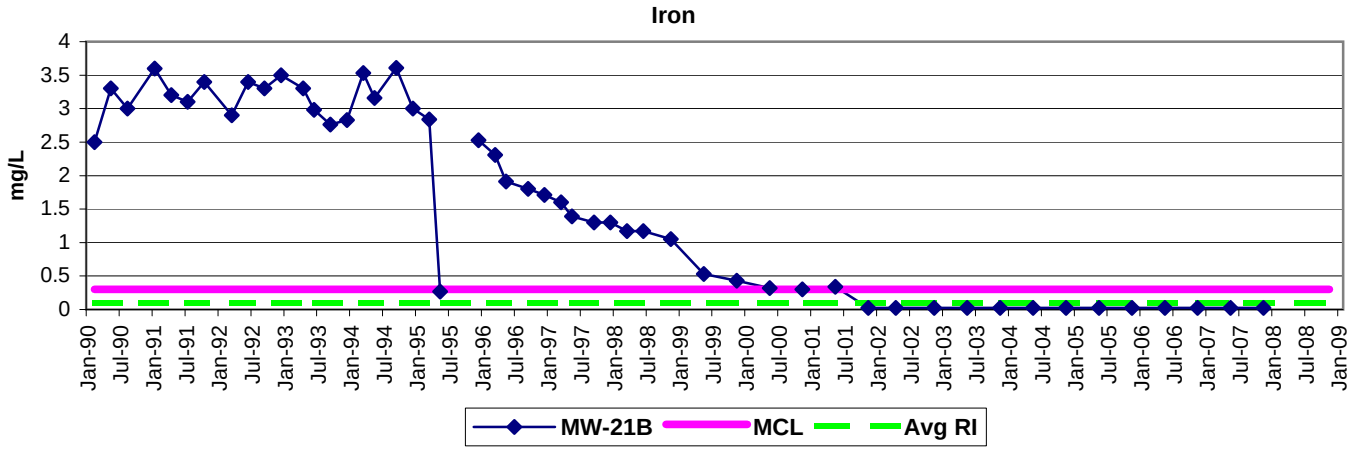
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-21B



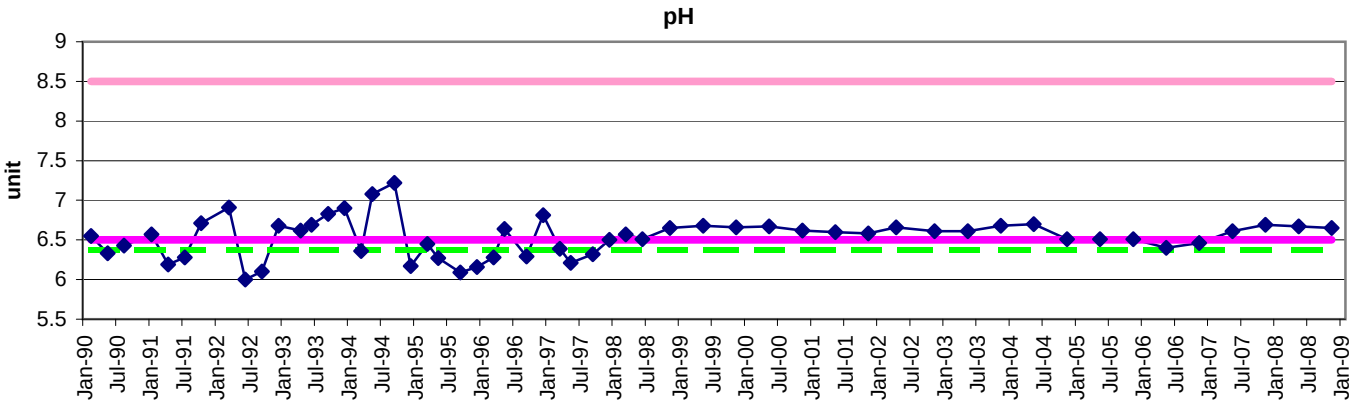


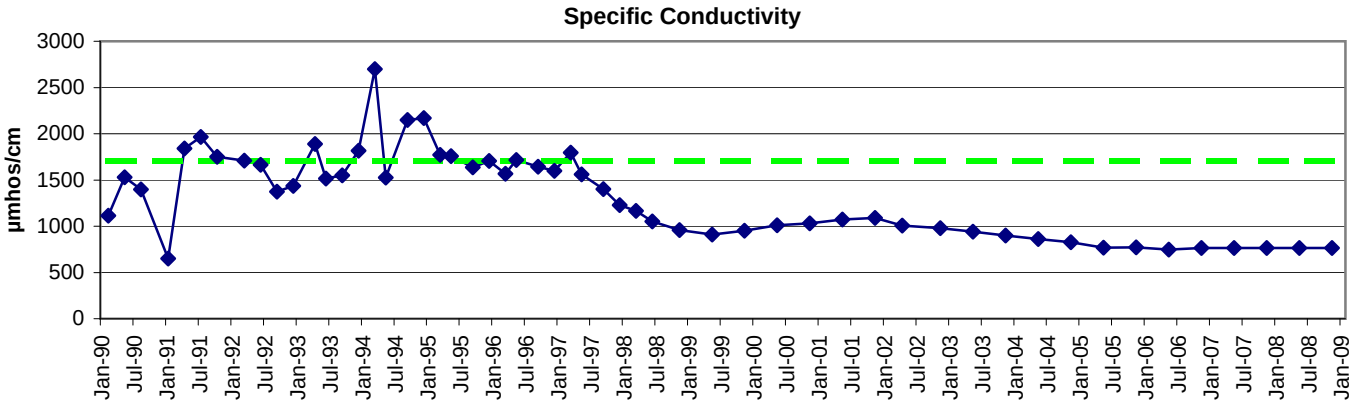


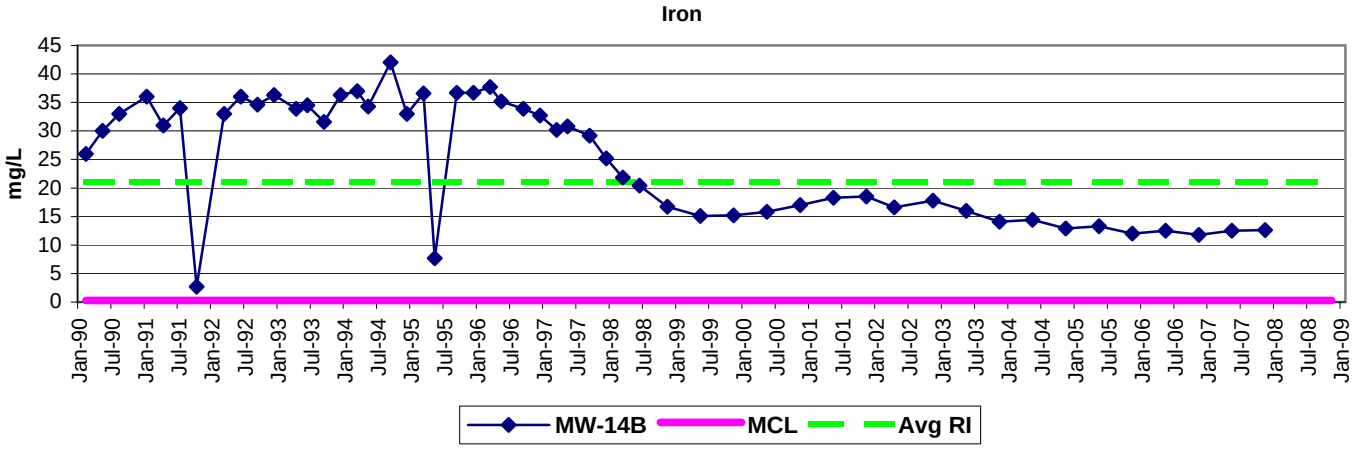
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-14B



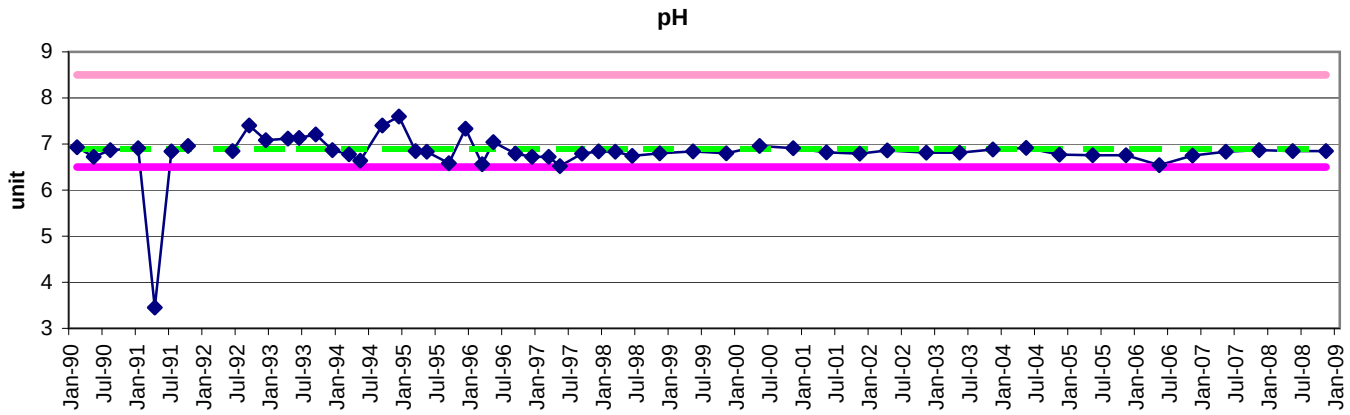


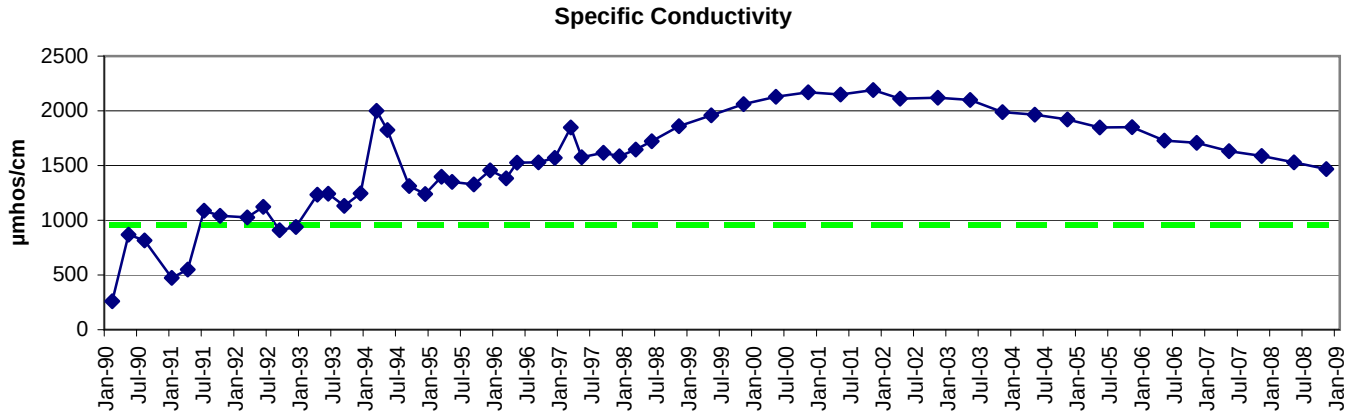


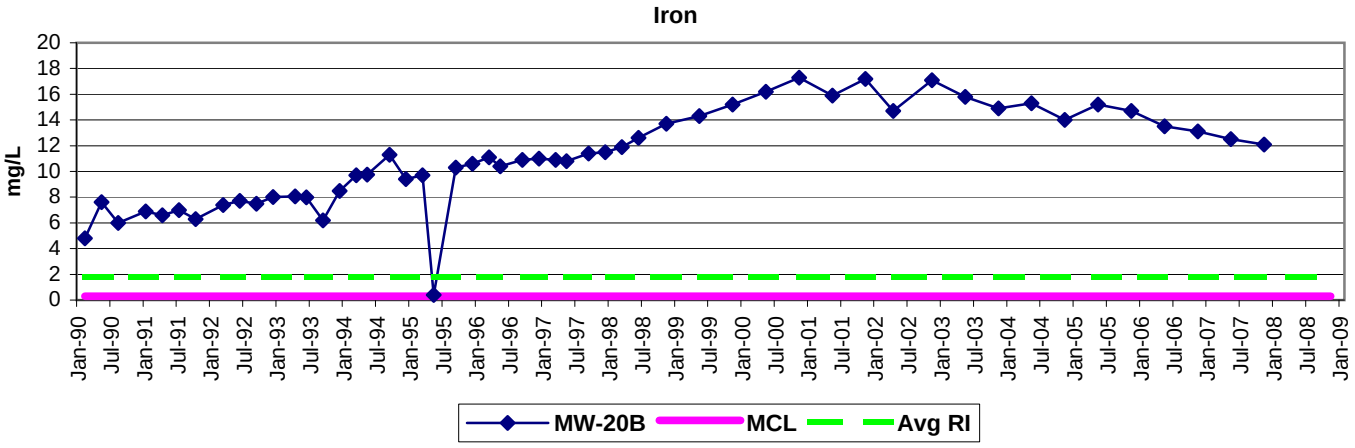
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-20B



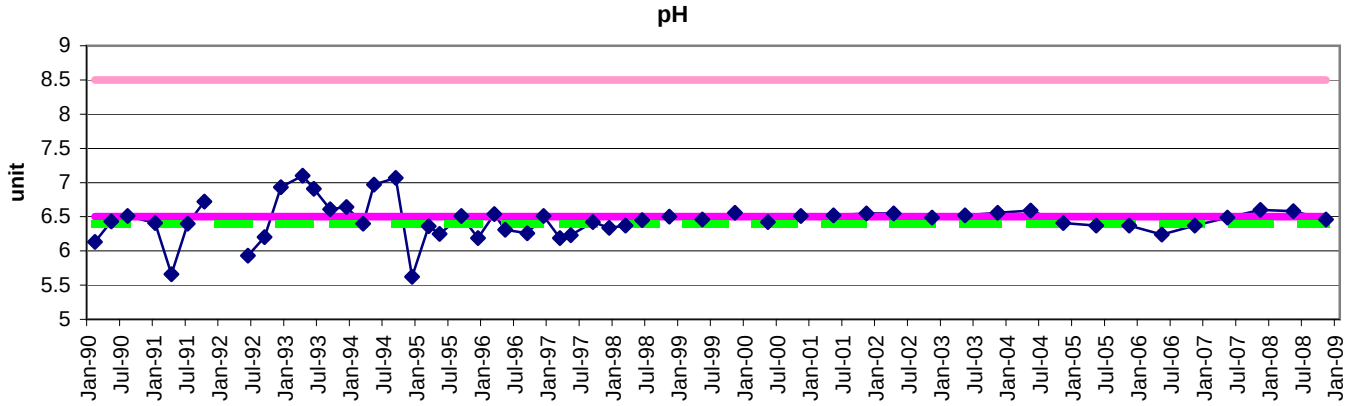


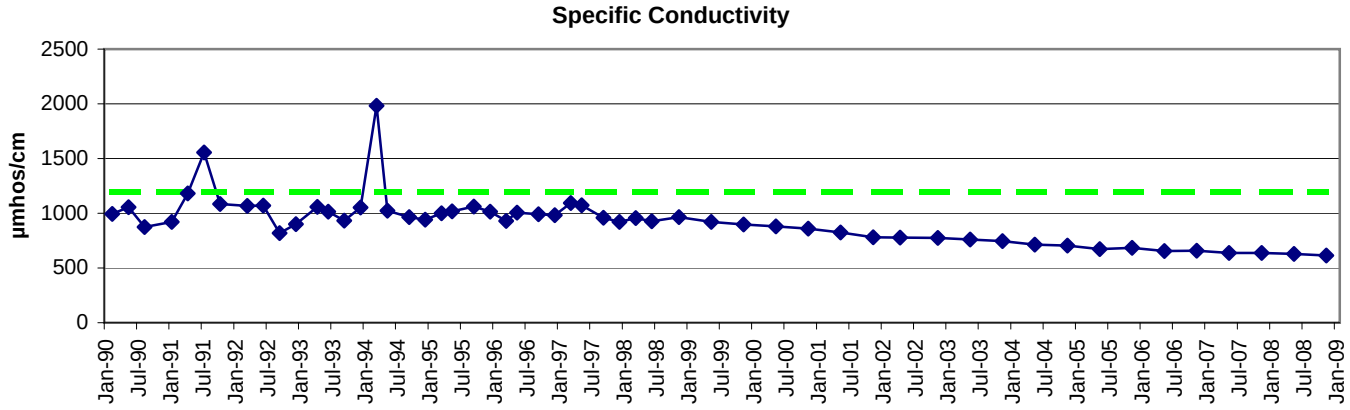


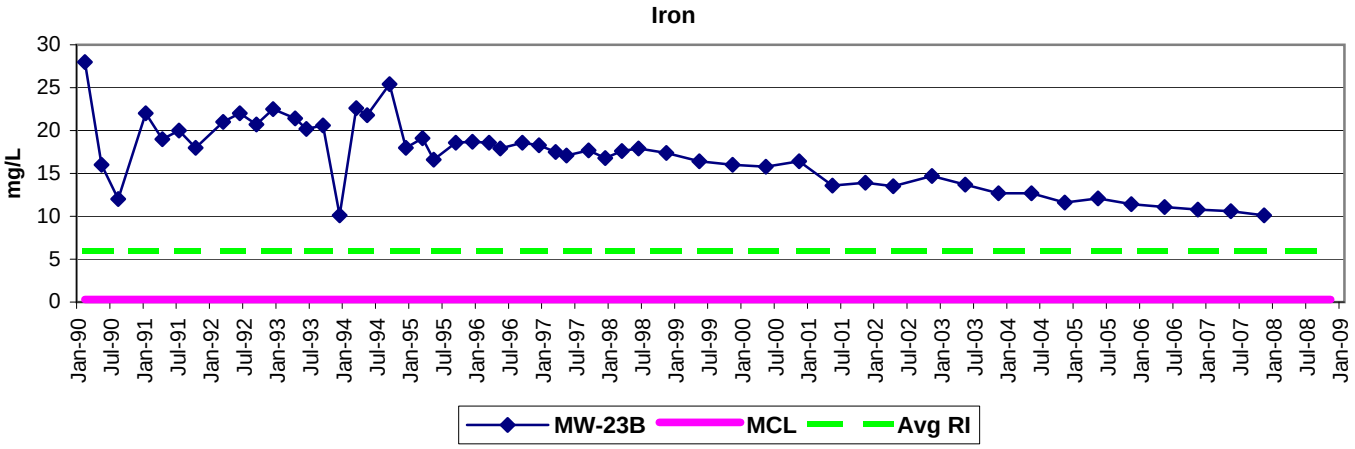
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-23B



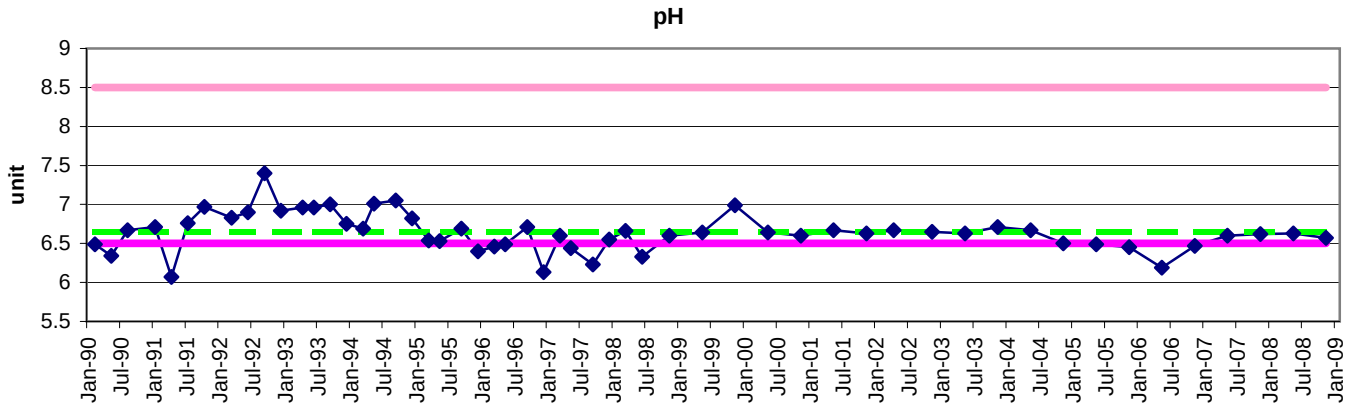


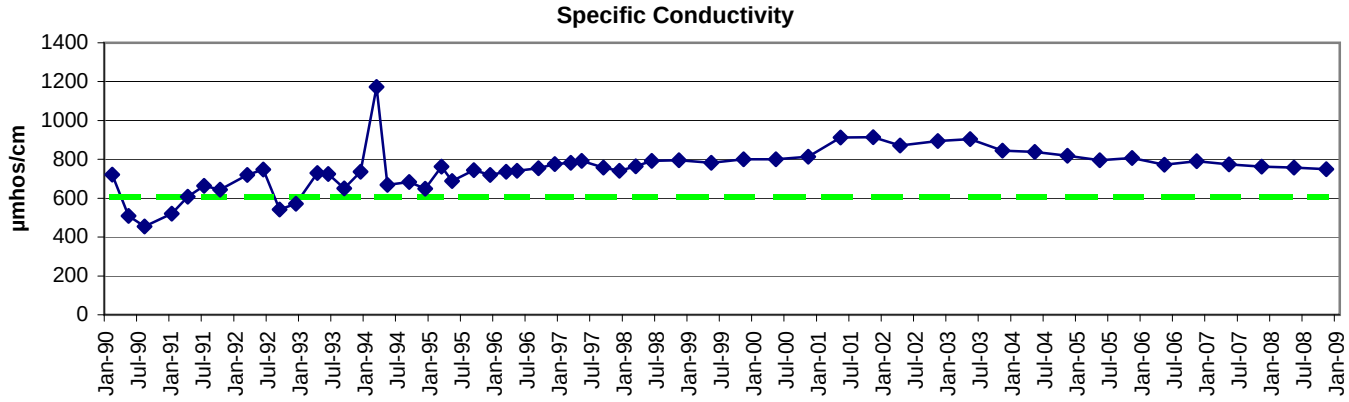


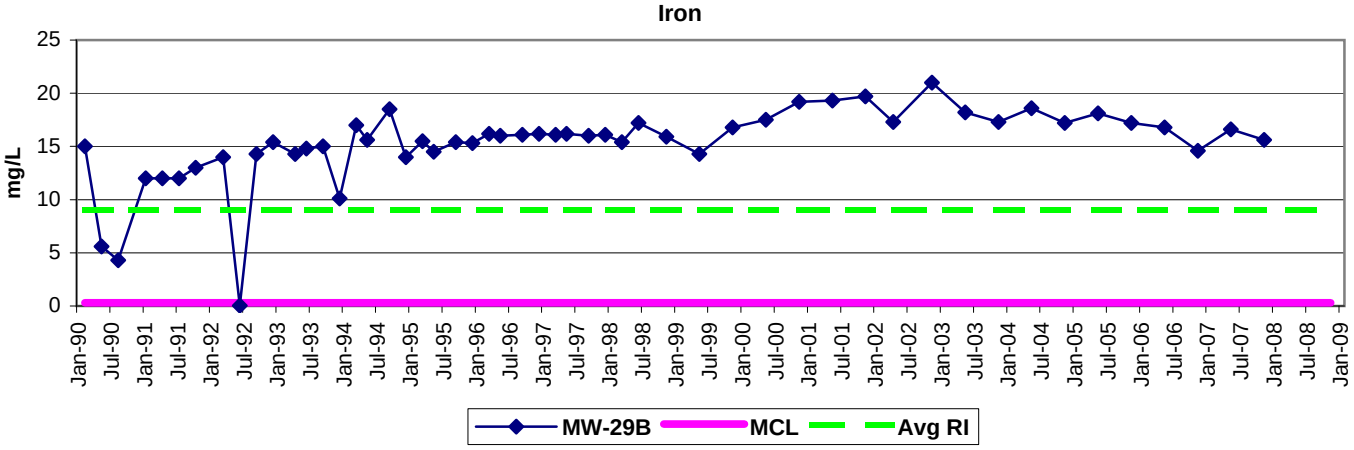
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-29B



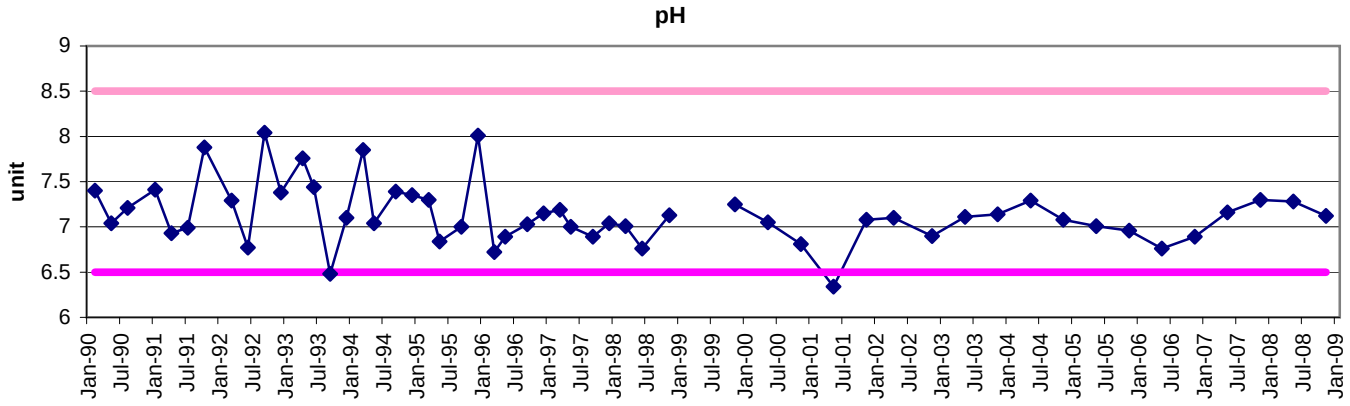


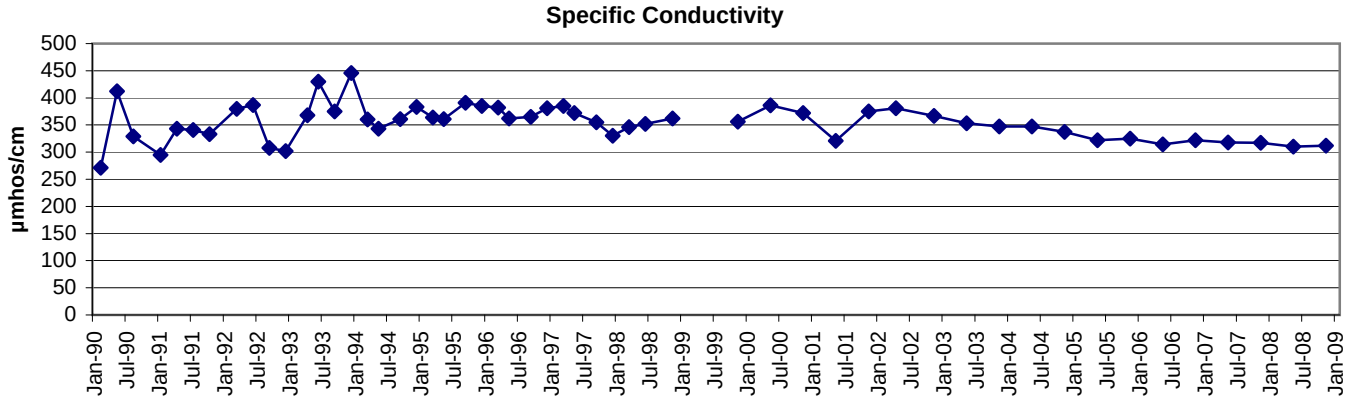


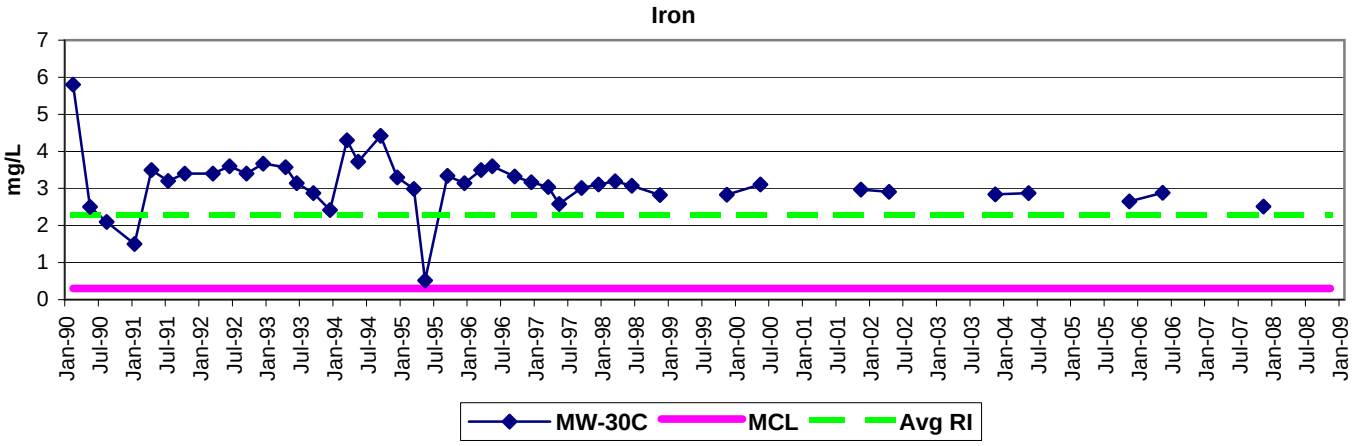
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-30C



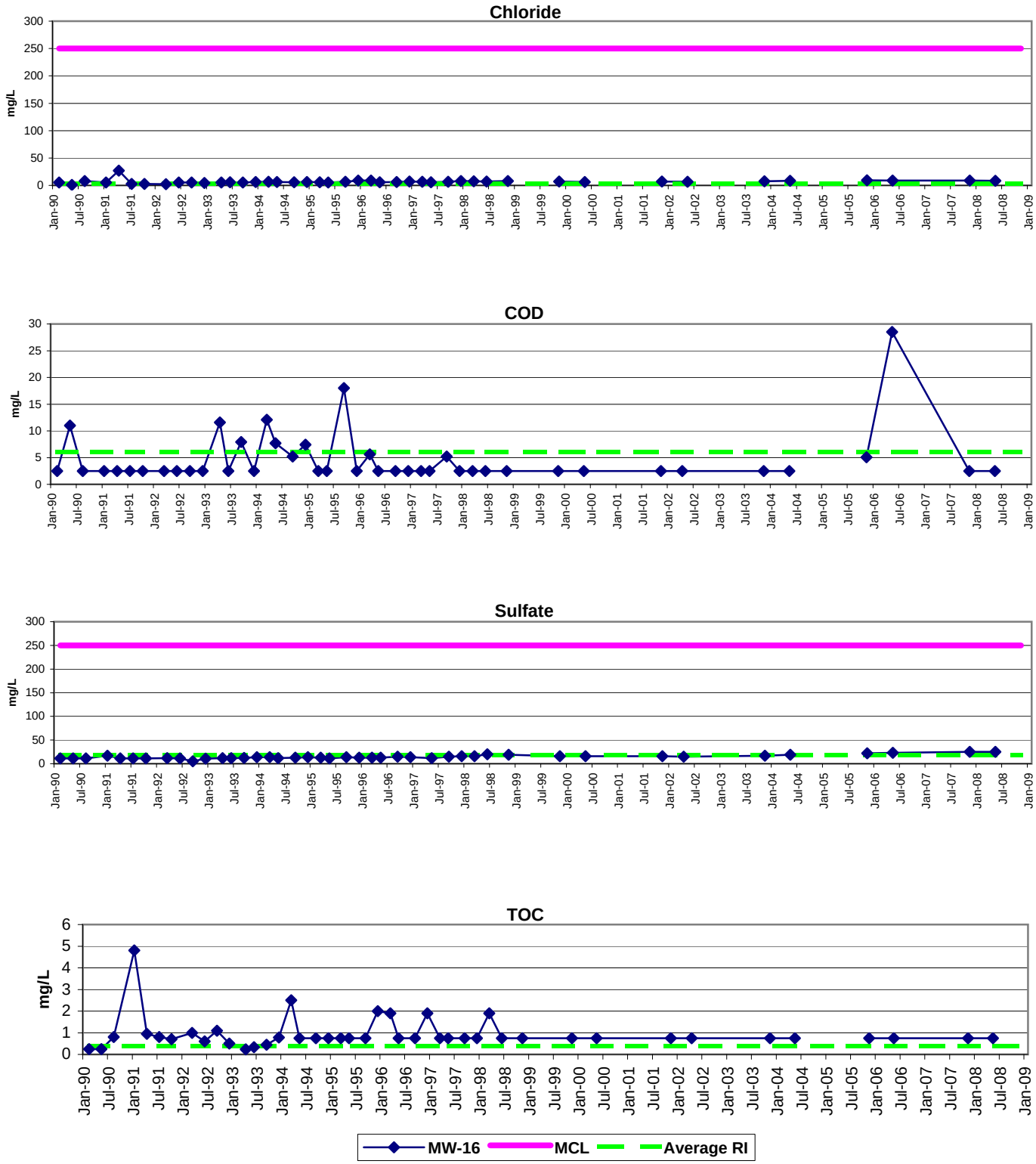




Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

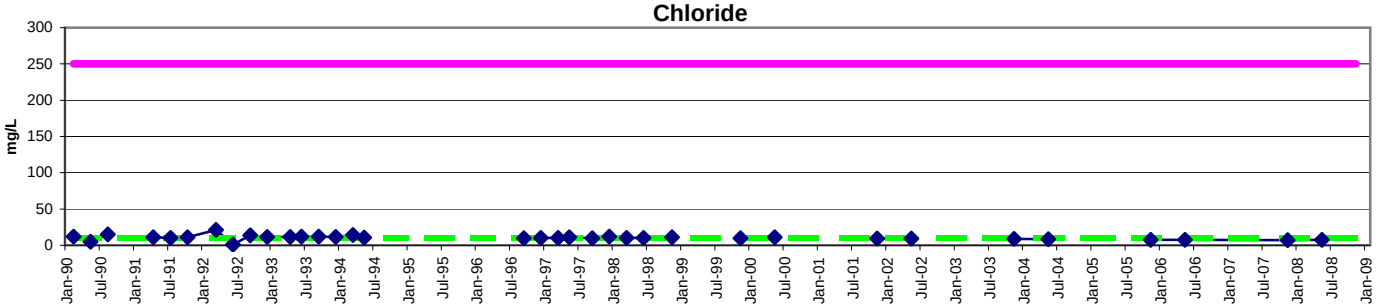
Upgradient Upper Gravel Aquifer Well
MW-16

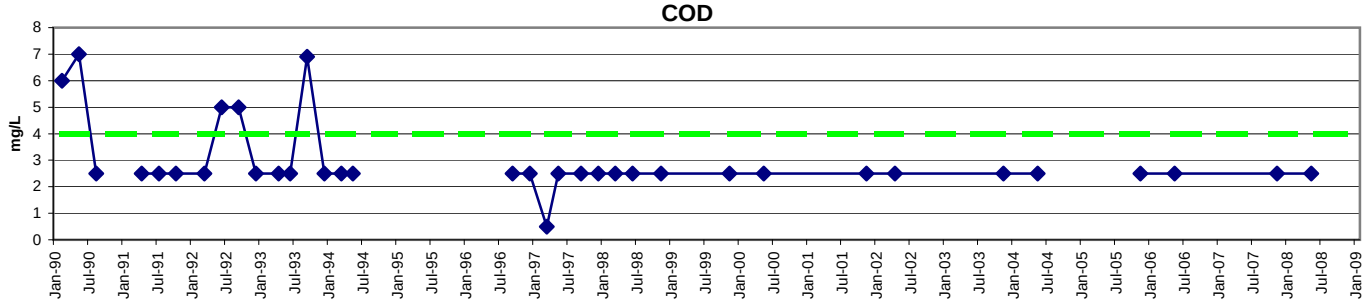


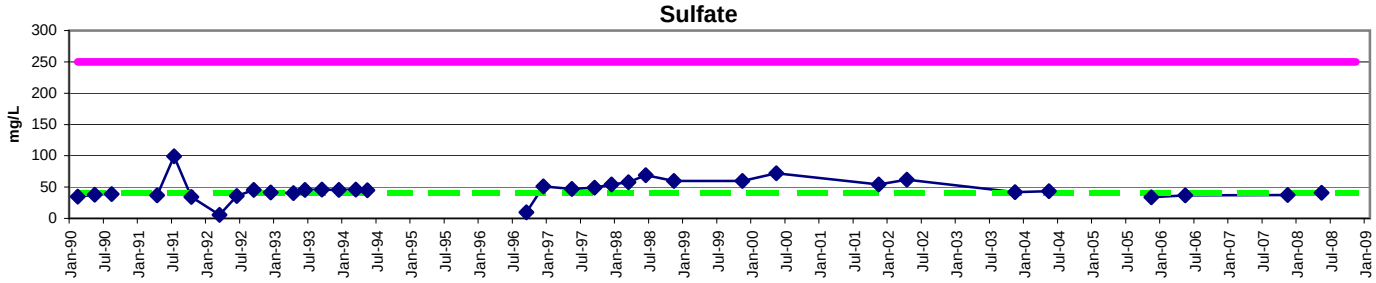
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

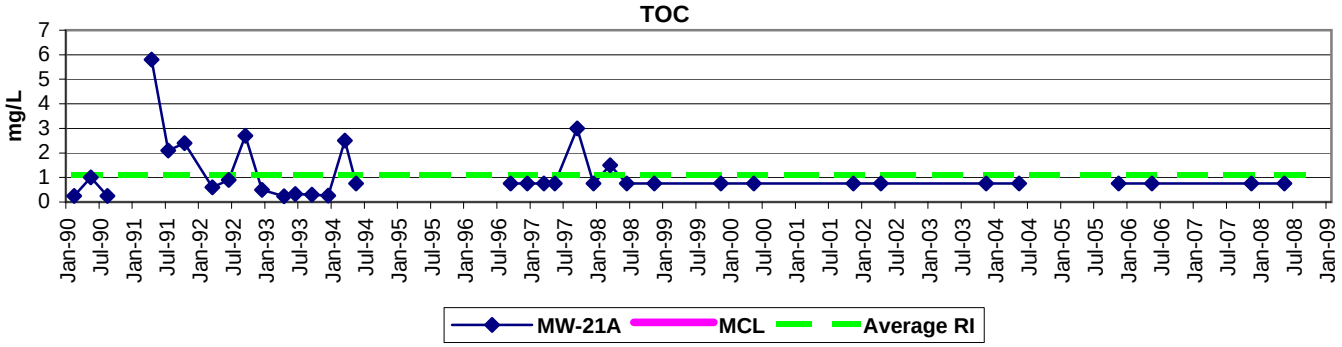
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Upper Gravel Aquifer Well
MW-21A









Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

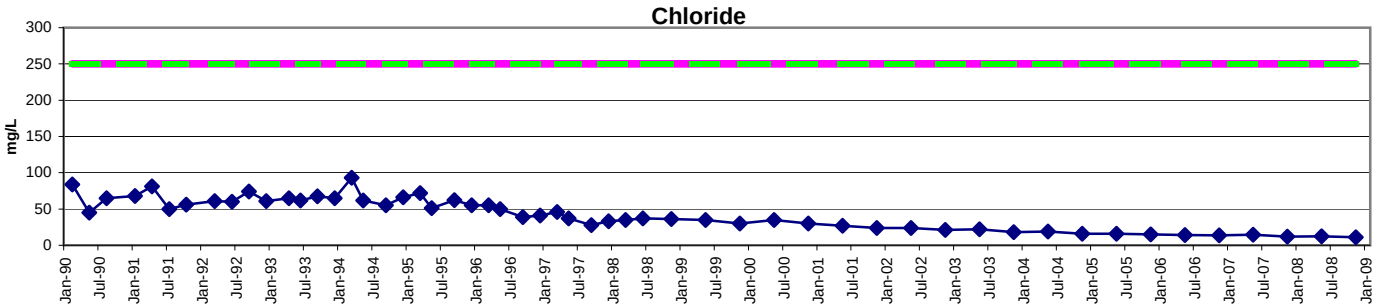
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

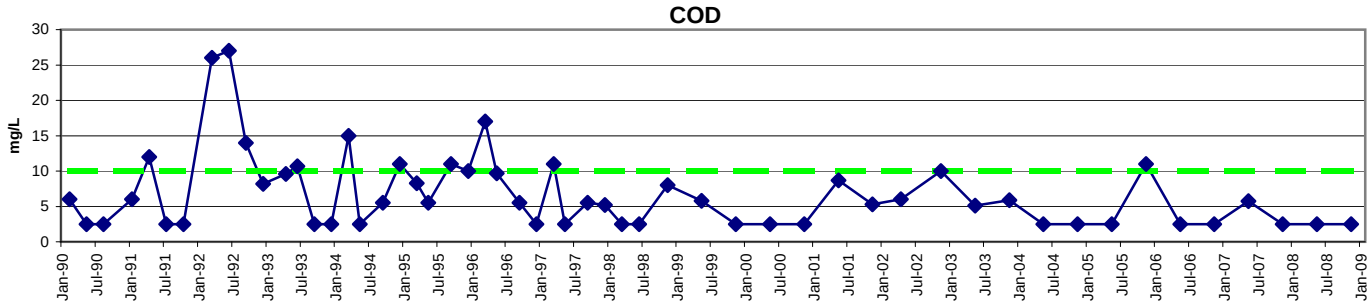
Upgradient Sand Aquifer Well
MW-8B

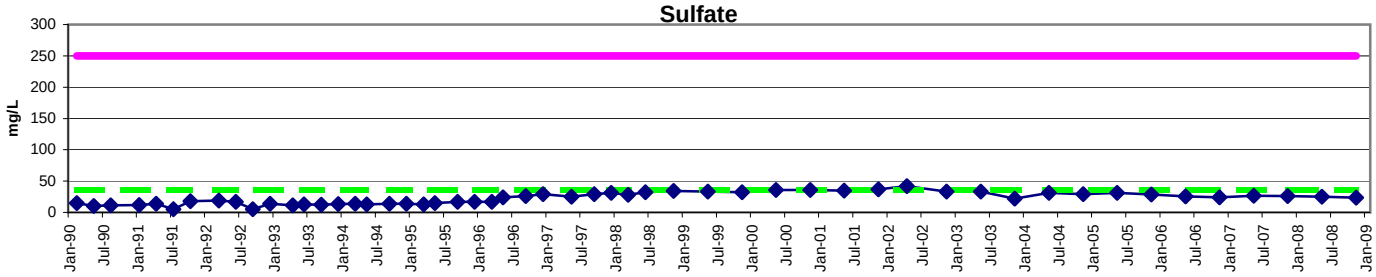
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

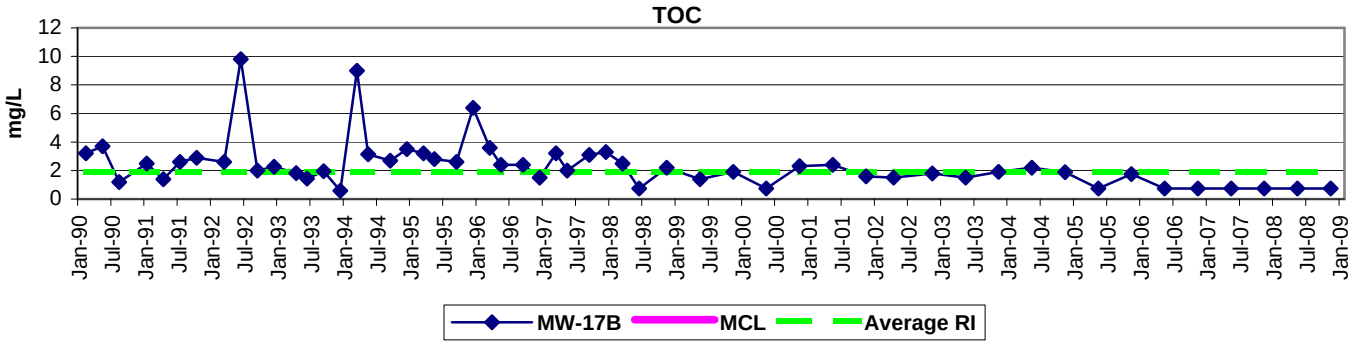
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-17B





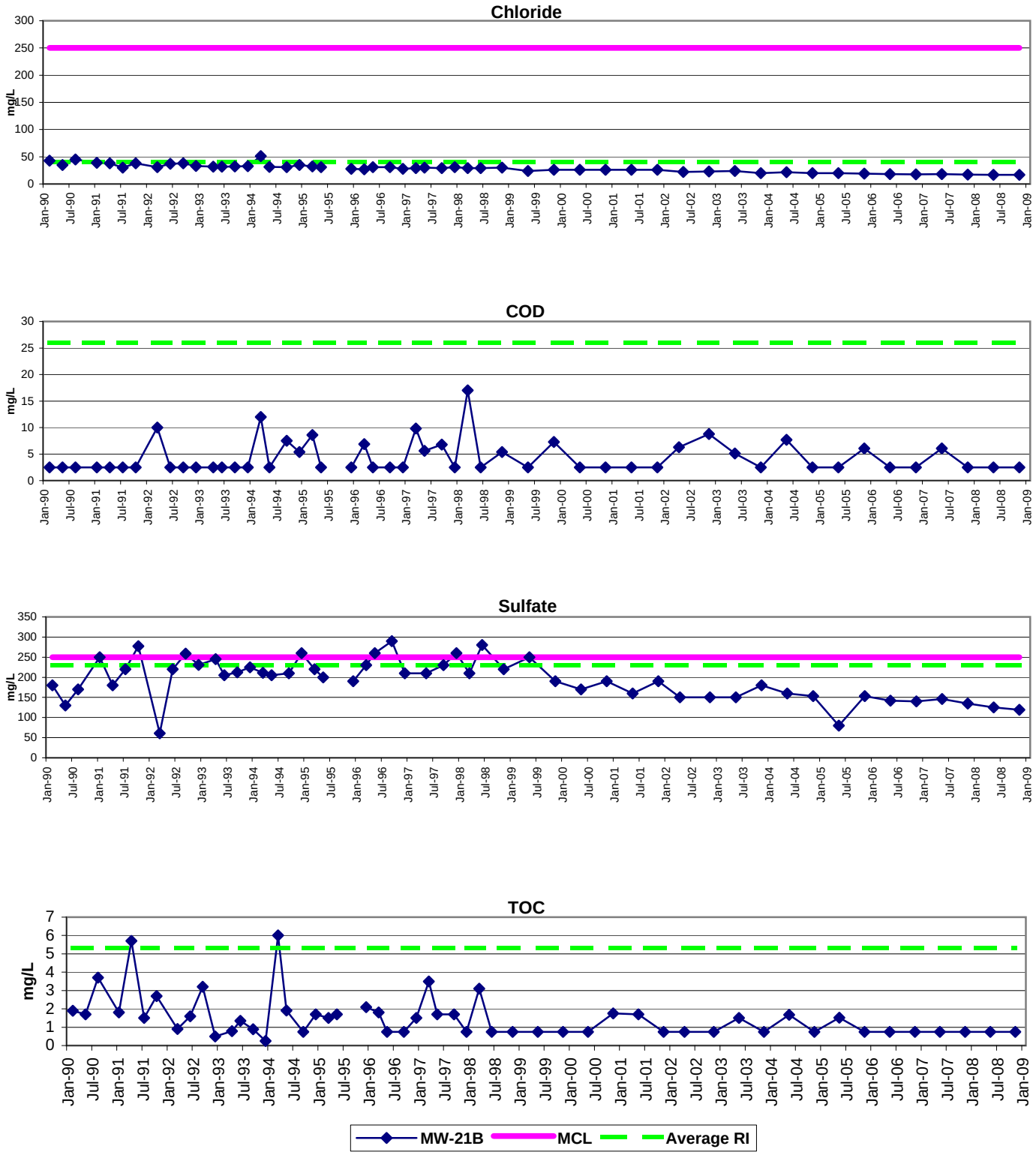




Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

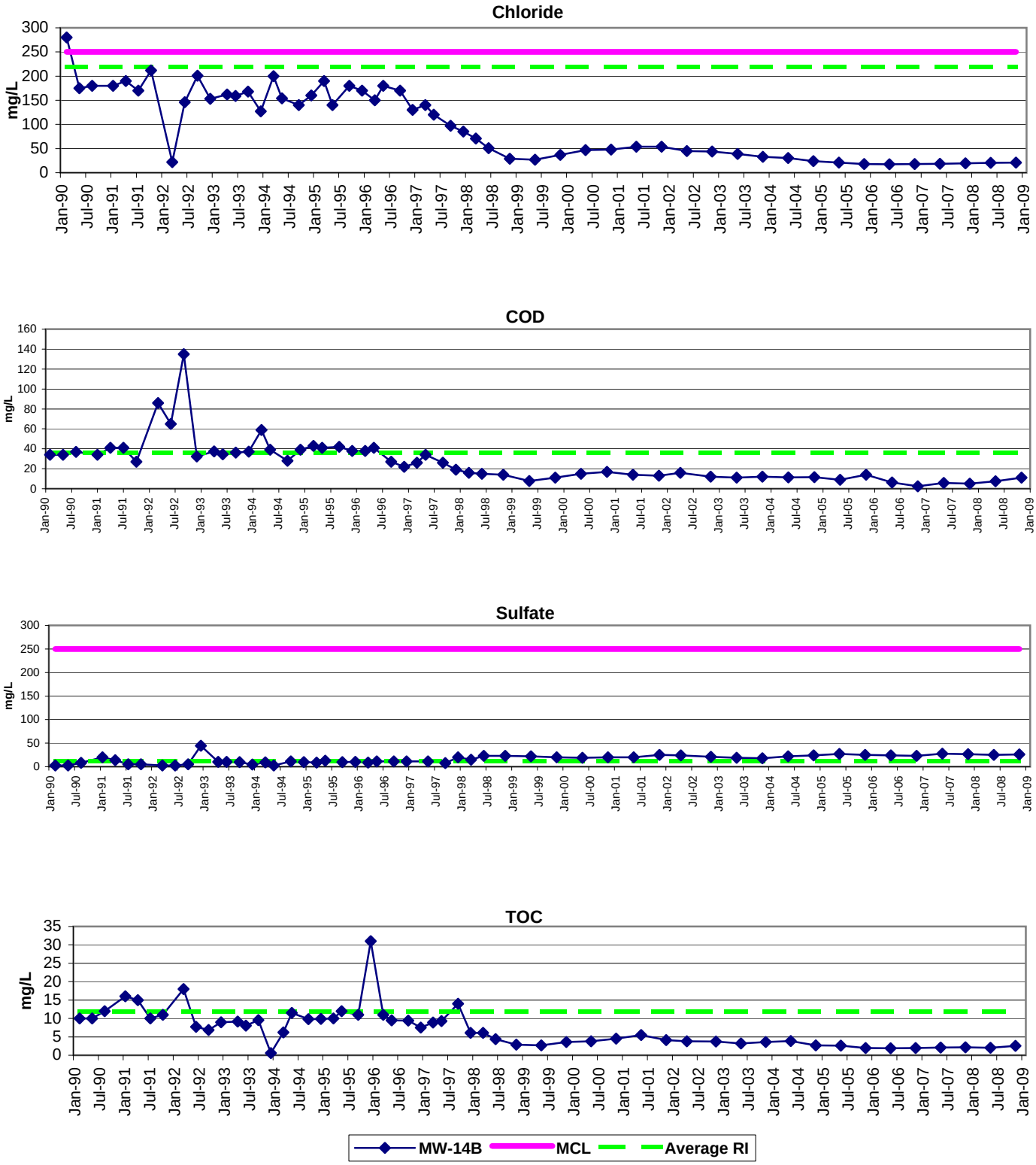
Upgradient Sand Aquifer Well
MW-21B



Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

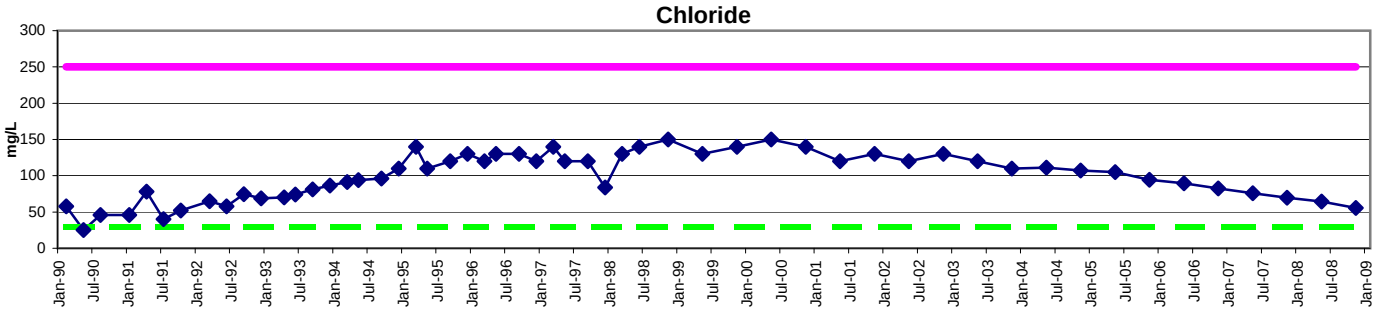
Downgradient Southern Gravel Aquifer Well
MW-14B

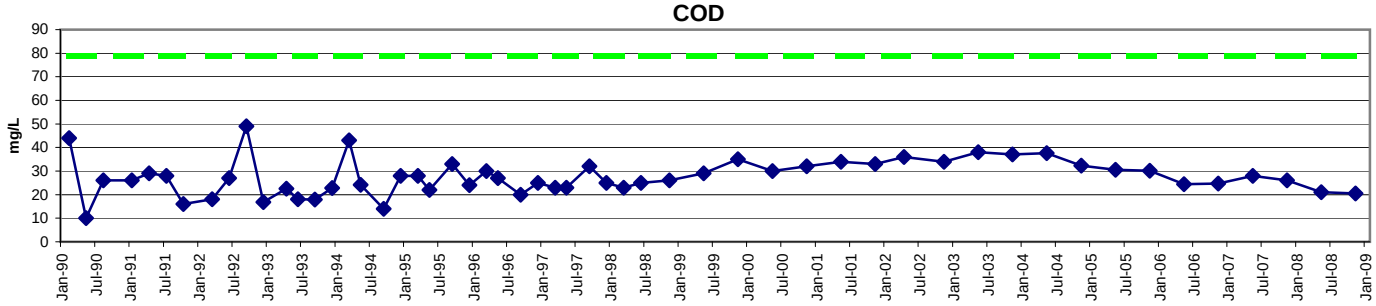


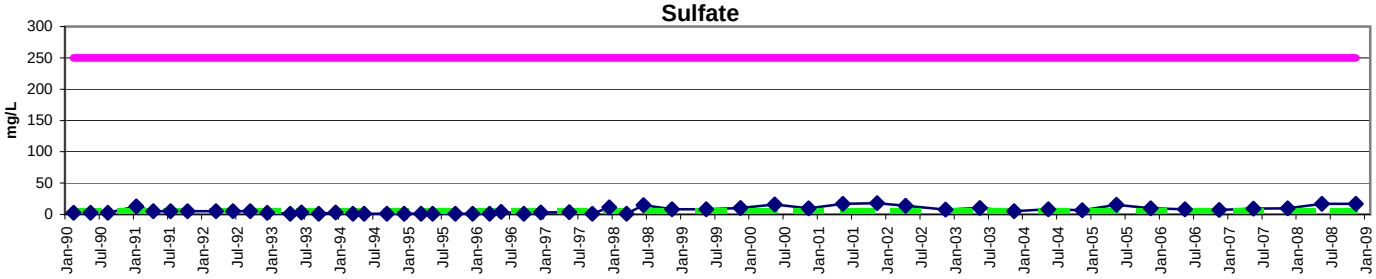
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

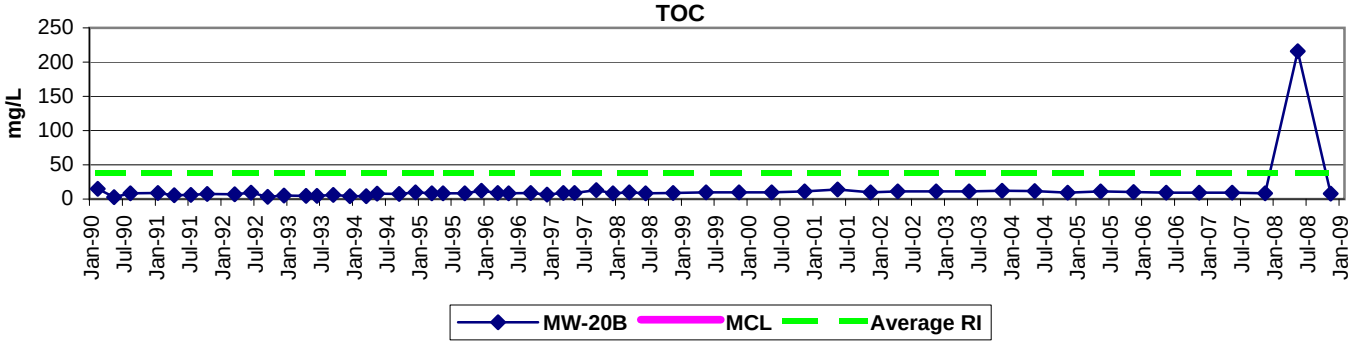
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-20B





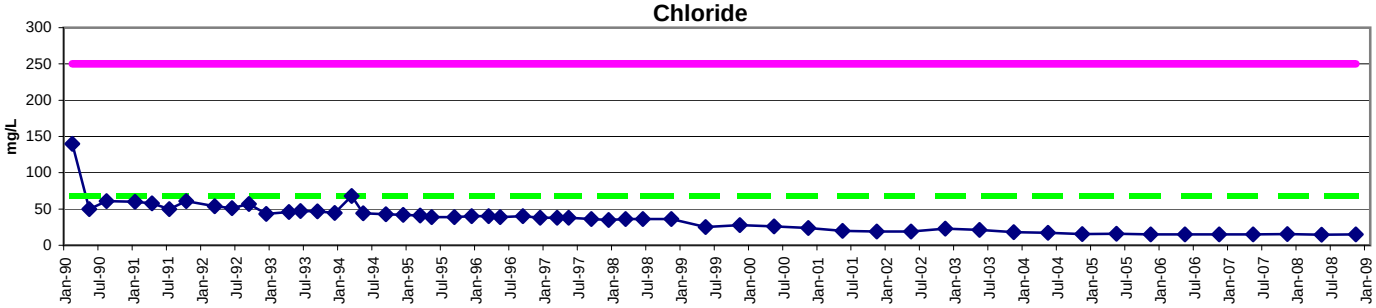


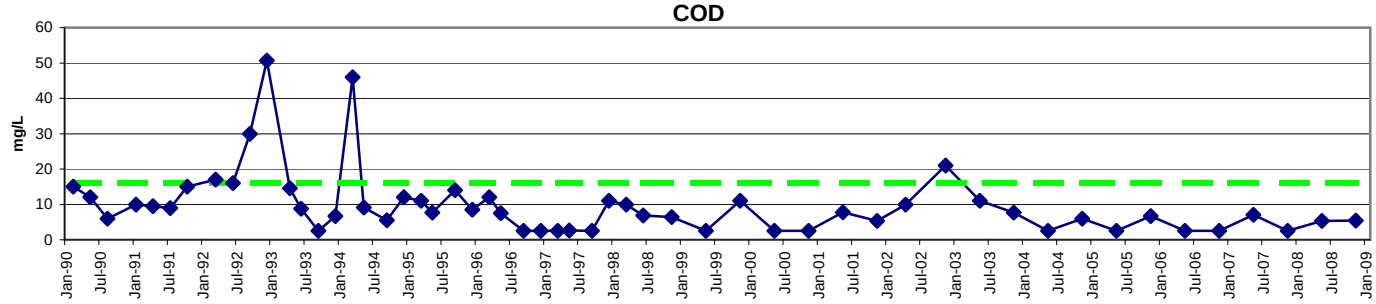


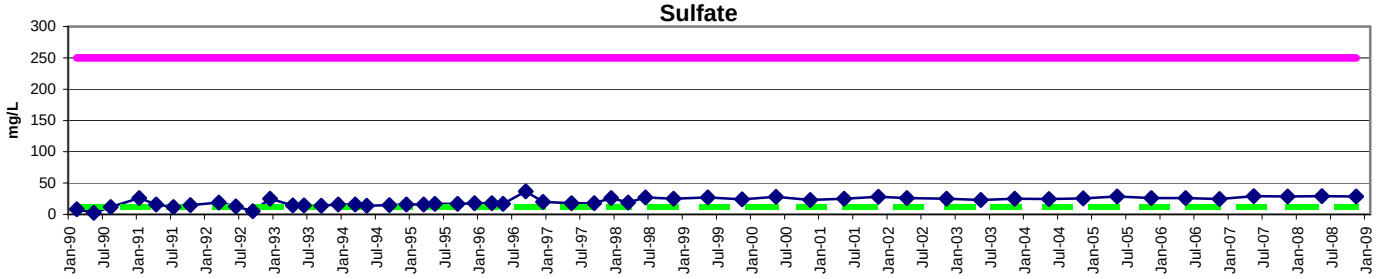
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

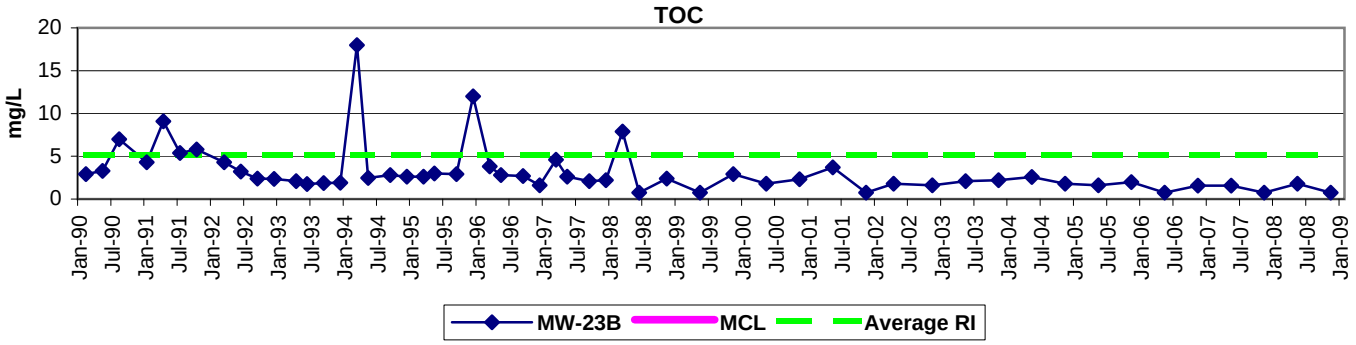
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-23B





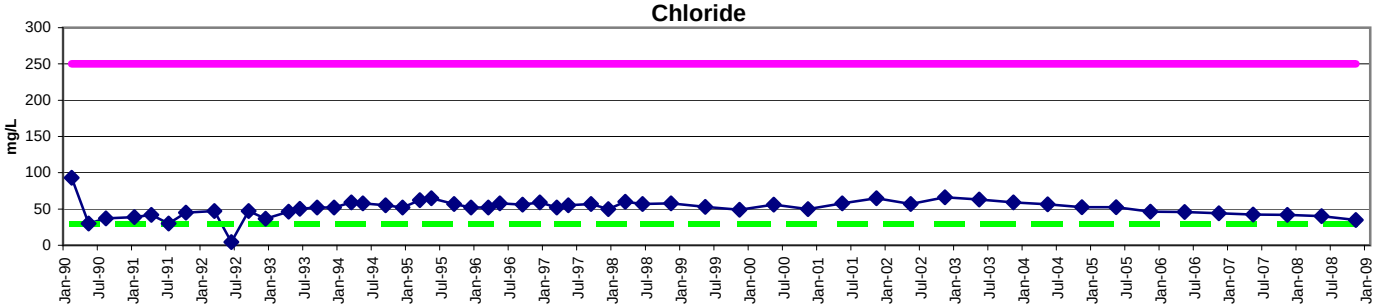


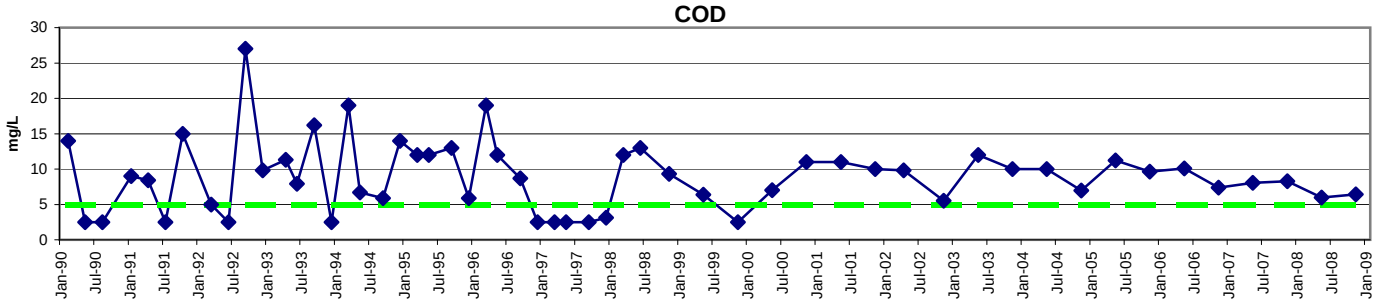


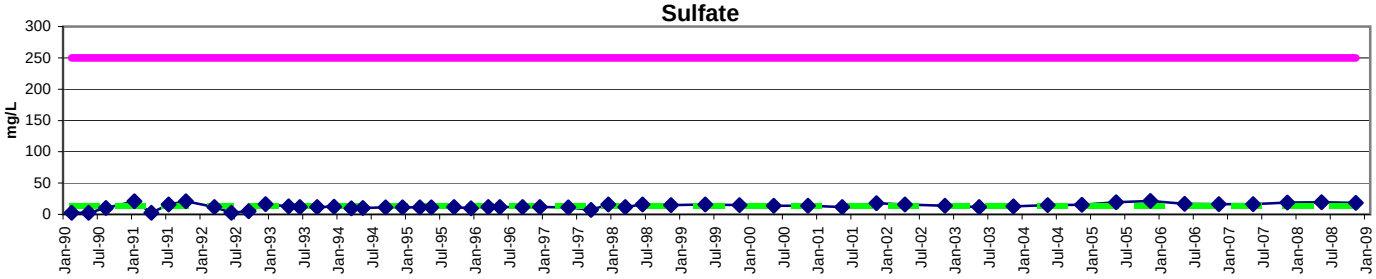
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

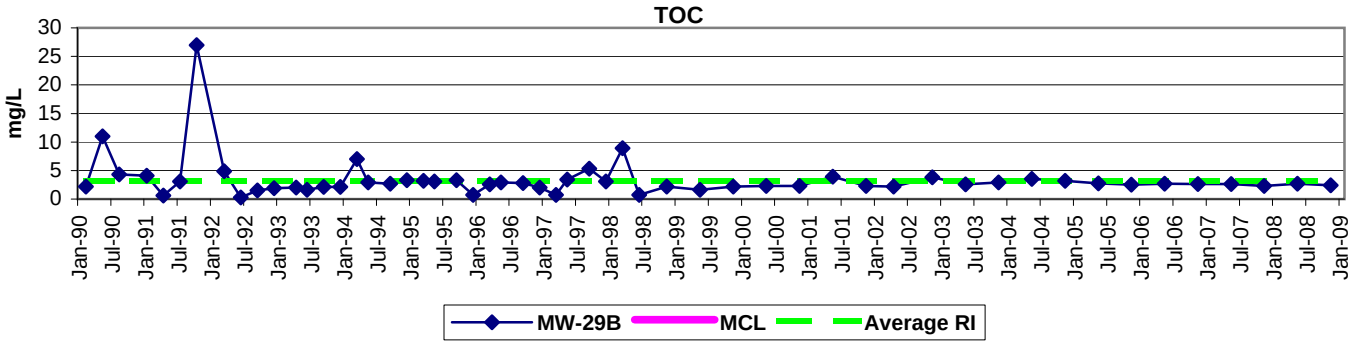
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-29B





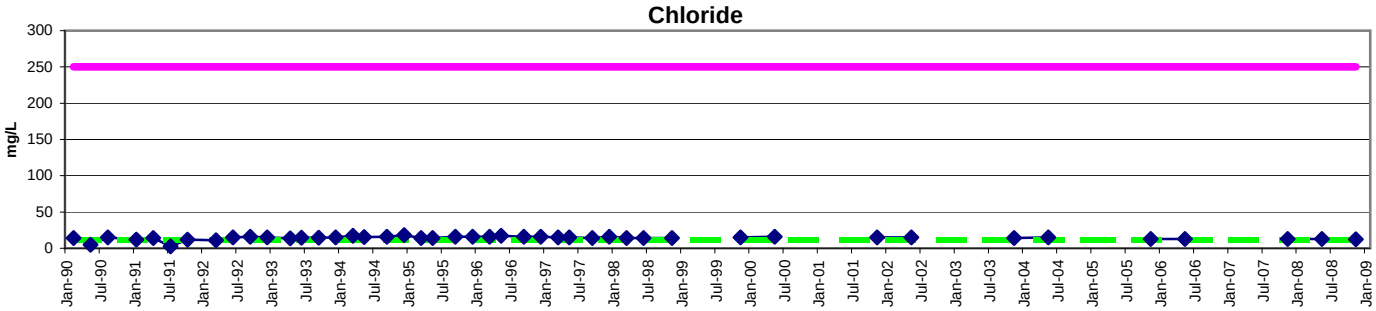


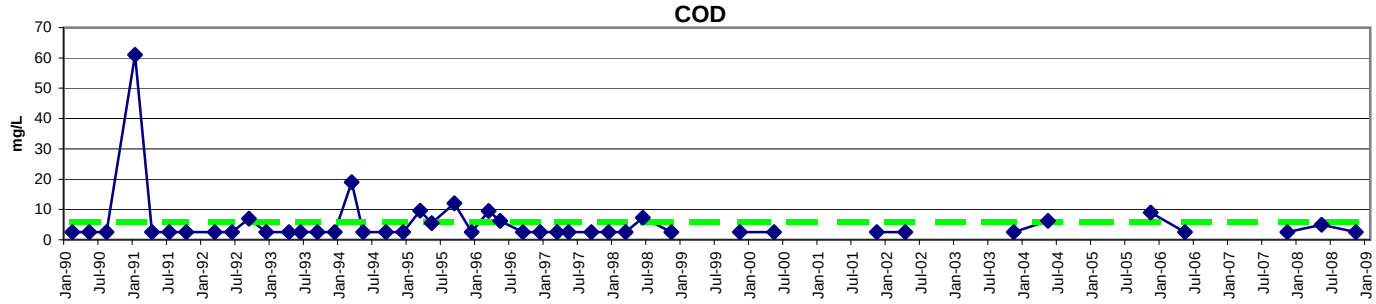


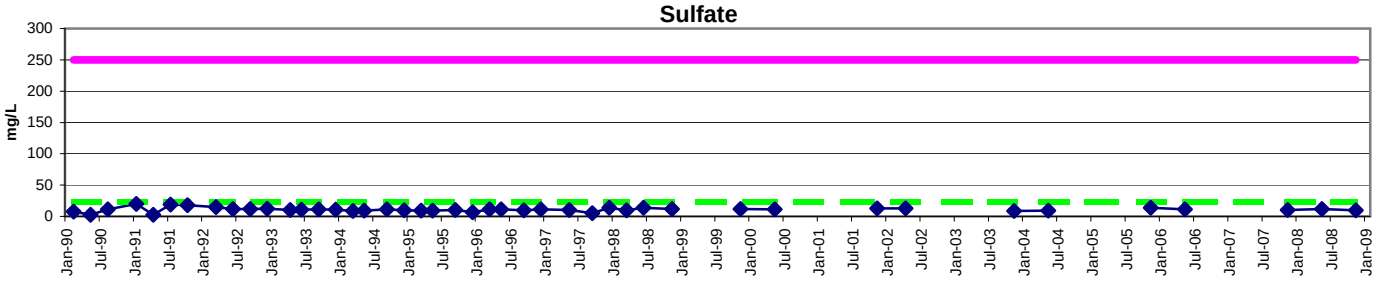
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

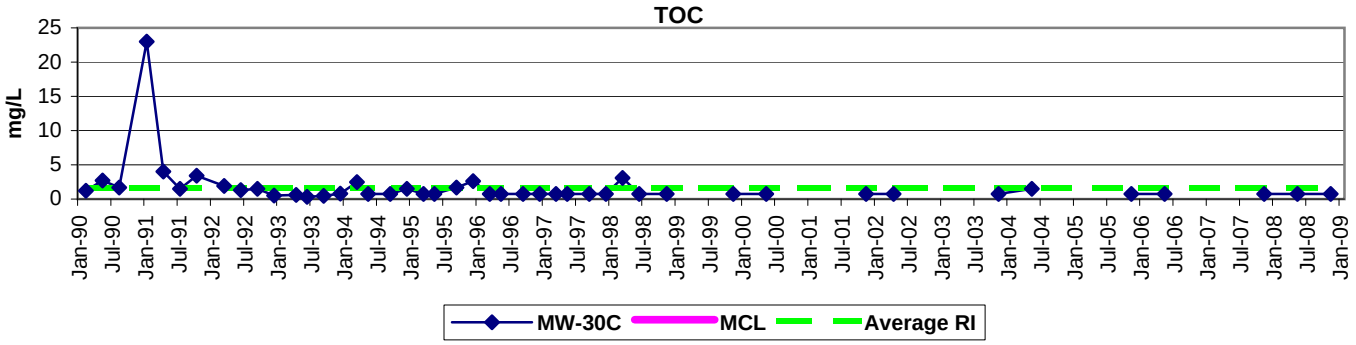
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-30C





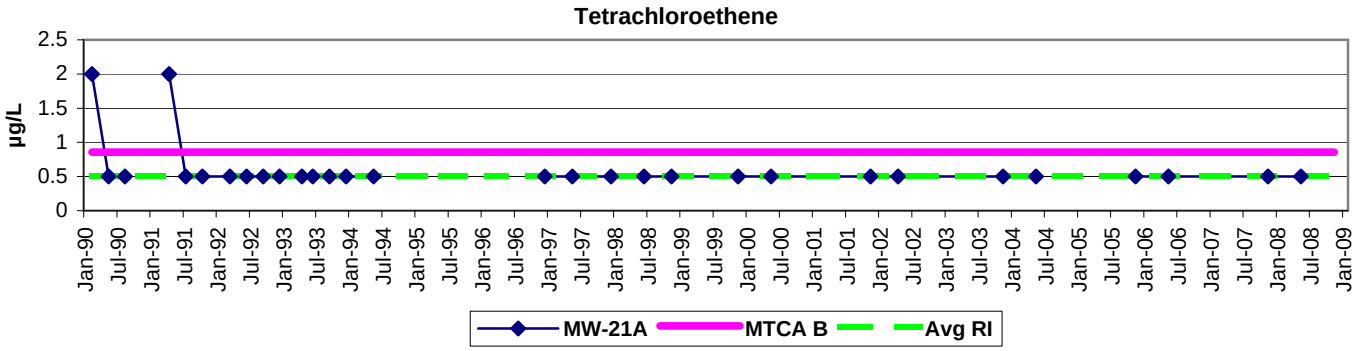


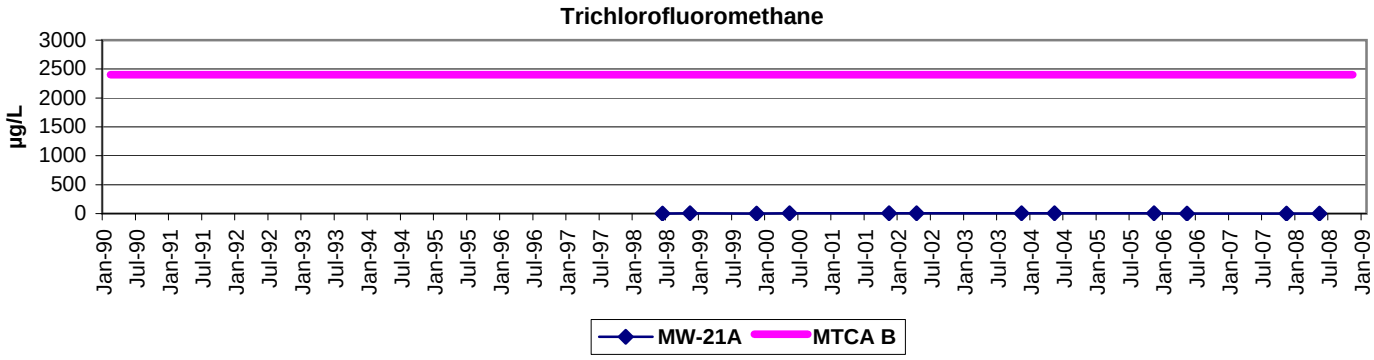


Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Upper Gravel Aquifer Well
MW-21A

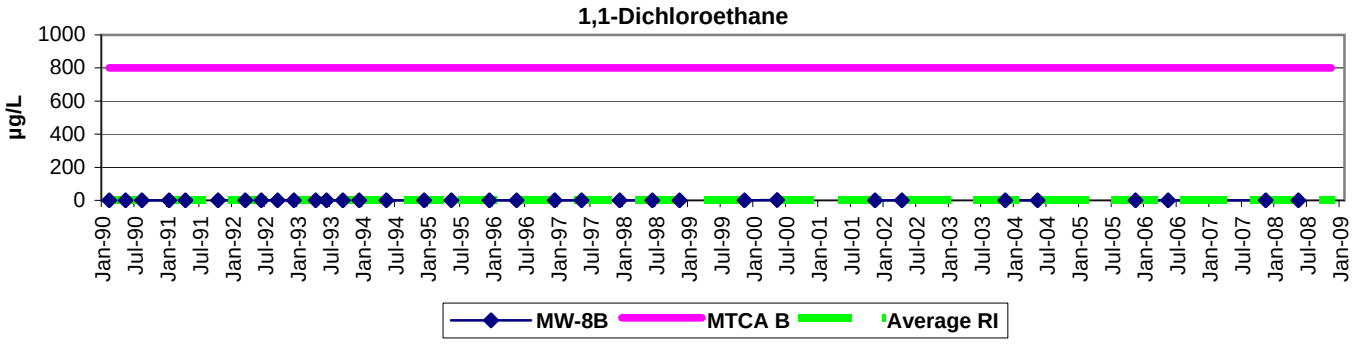




Non-detected values are shown as 1/2 the detection limit.
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-8B

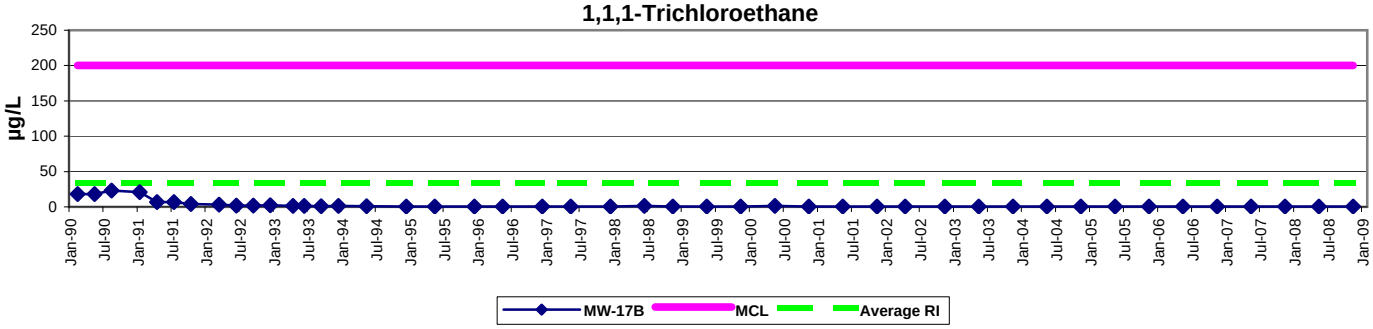


Non-detected values are shown as 1/2 the detection limit.
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

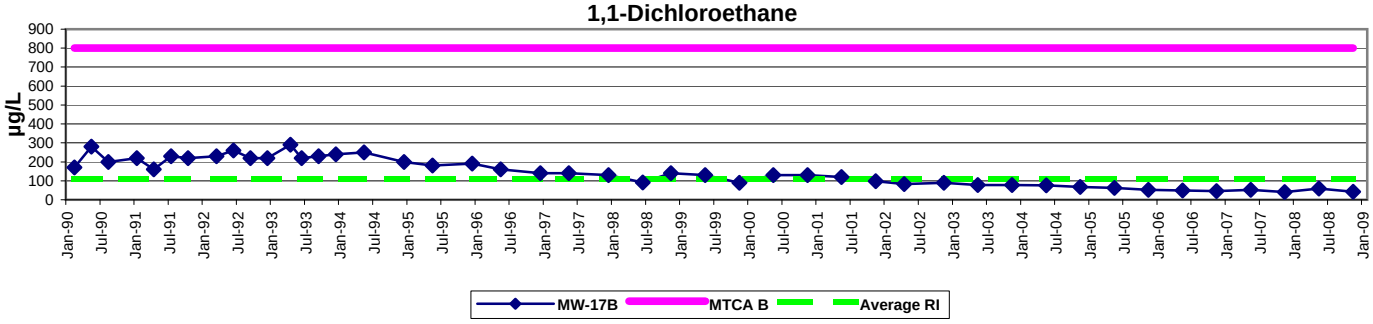
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-17B

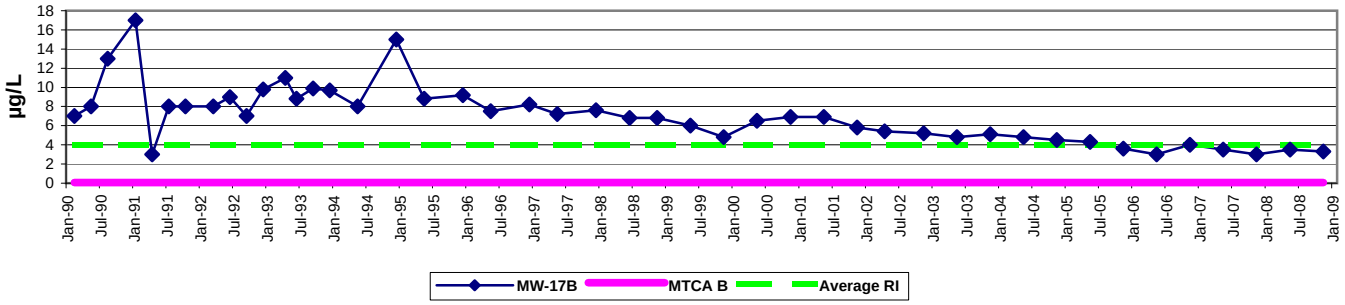
1,1,1-Trichloroethane



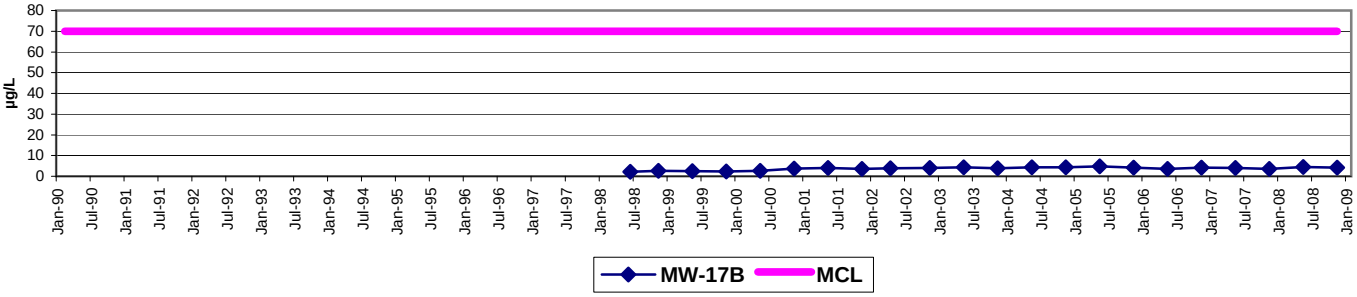
1,1-Dichloroethane



1,1-Dichloroethene



Cis-1,2-Dichloroethene



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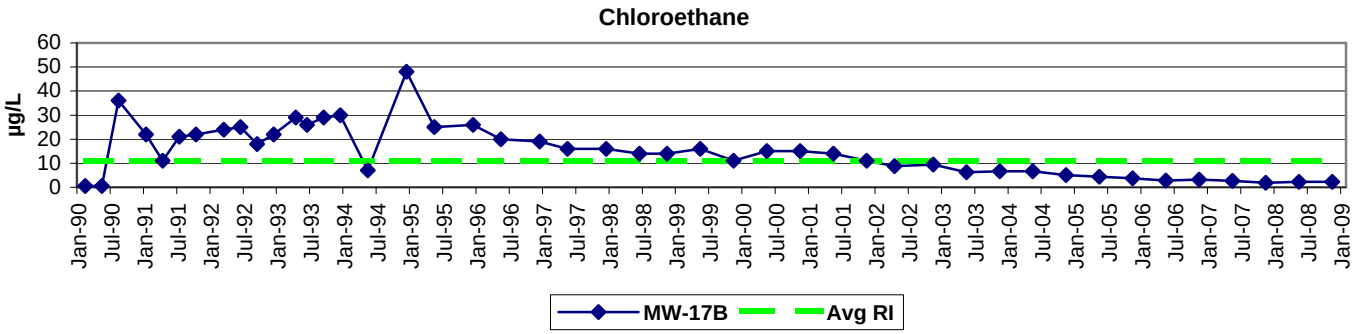
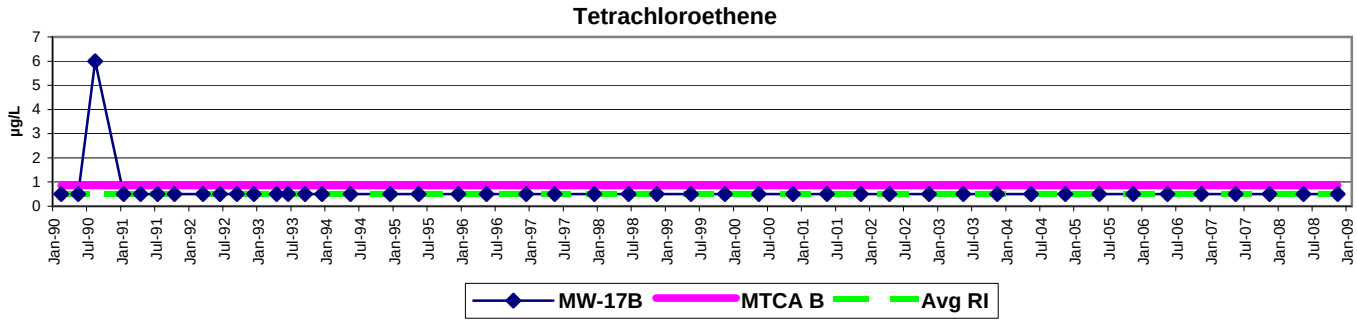
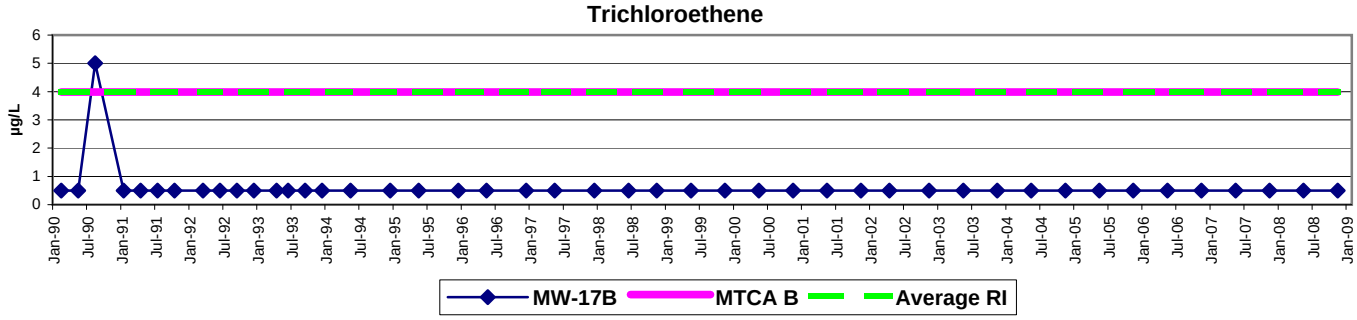
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-17B







Non-detected values are shown as 1/2 the detection limit.
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MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
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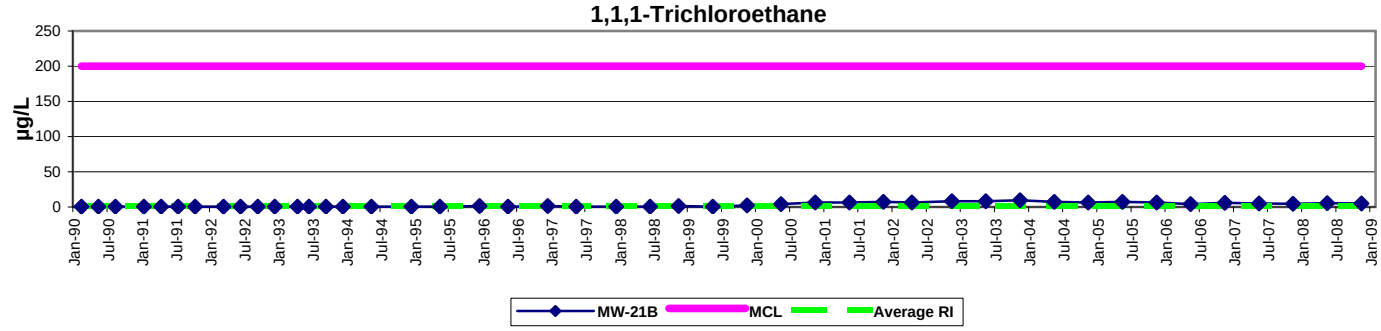
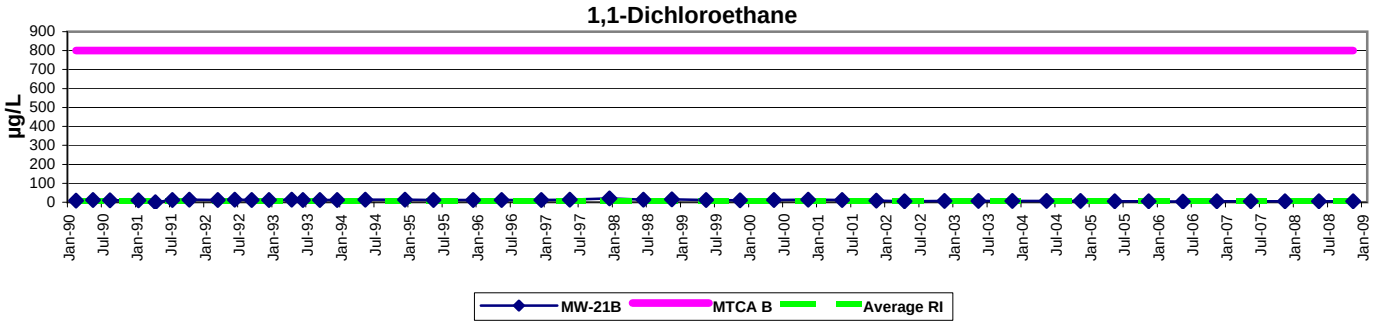
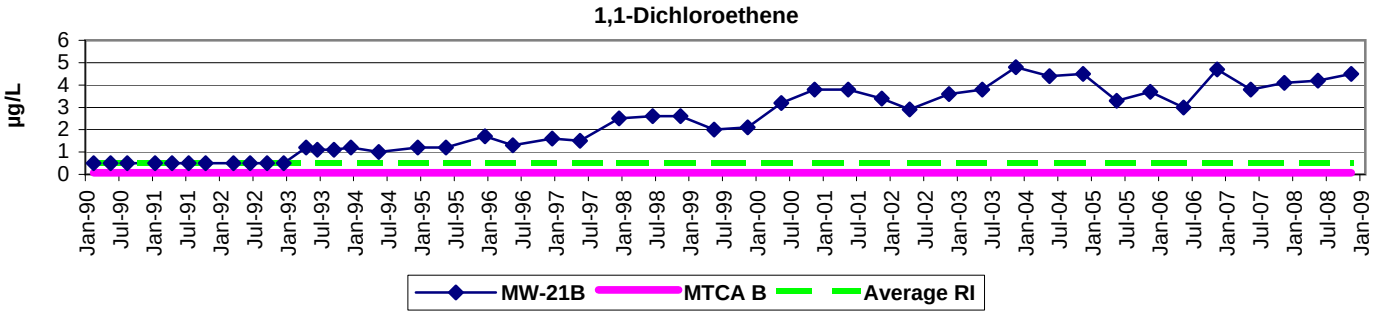
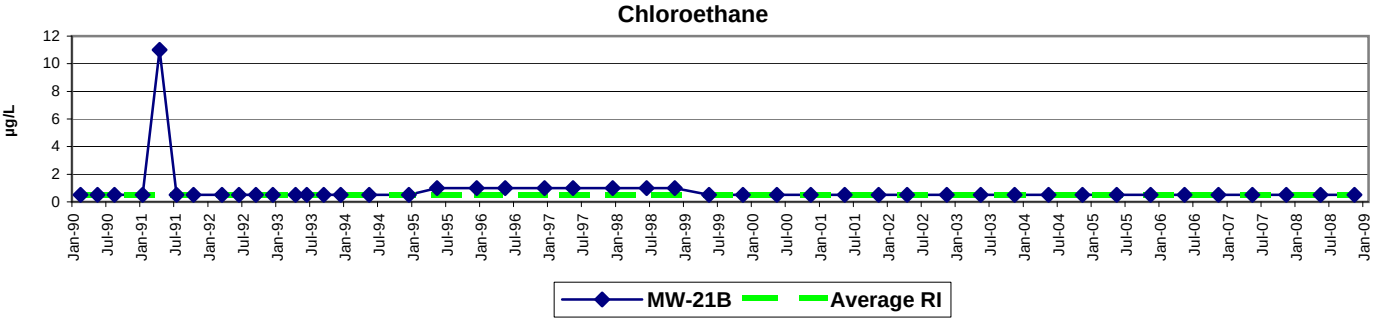
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-21B









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MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
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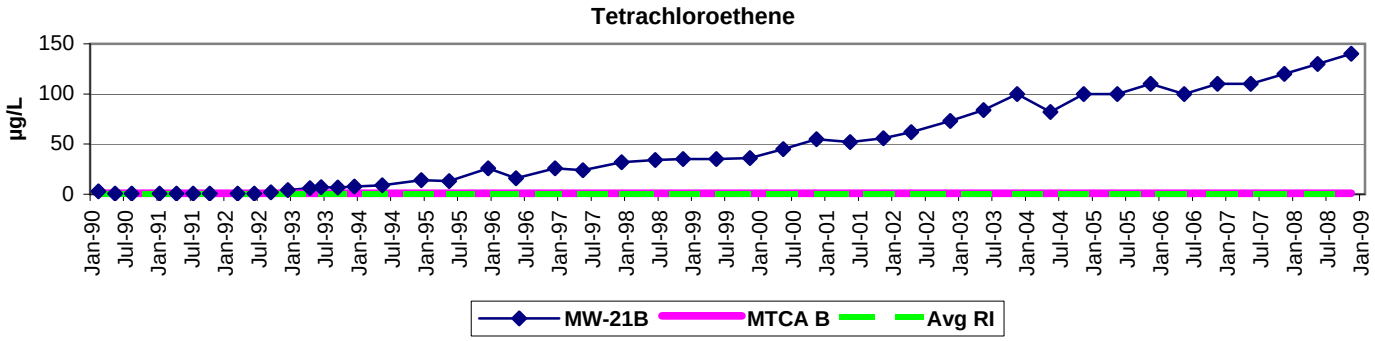
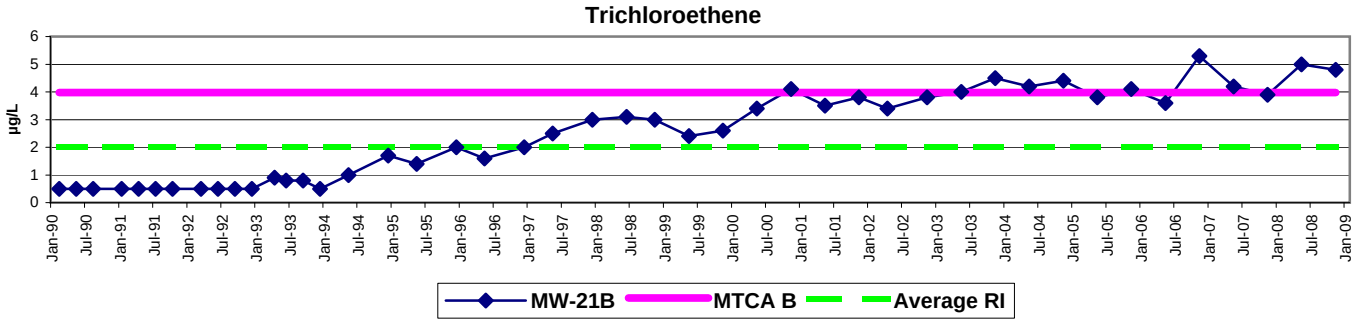
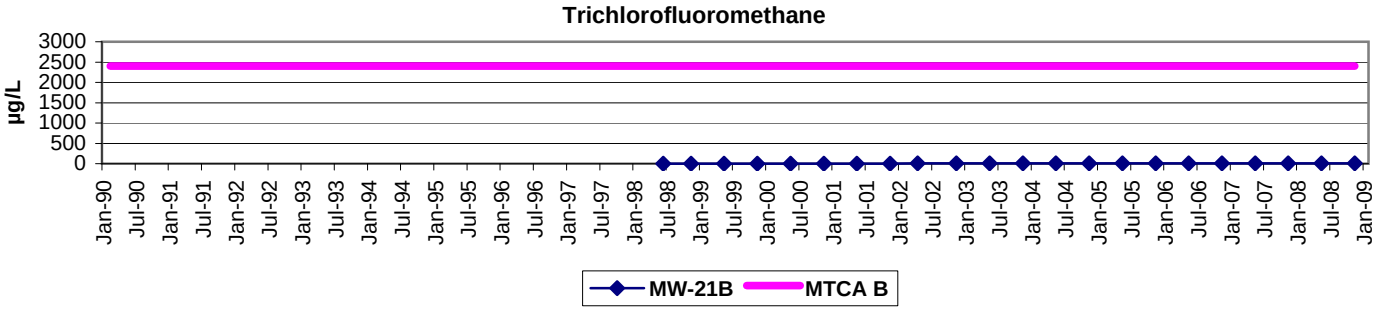
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Upgradient Sand Aquifer Well
MW-21B



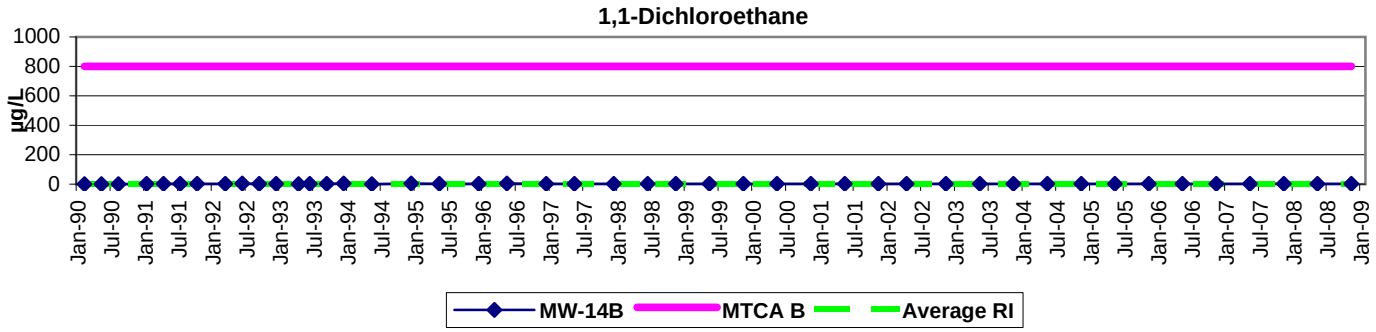


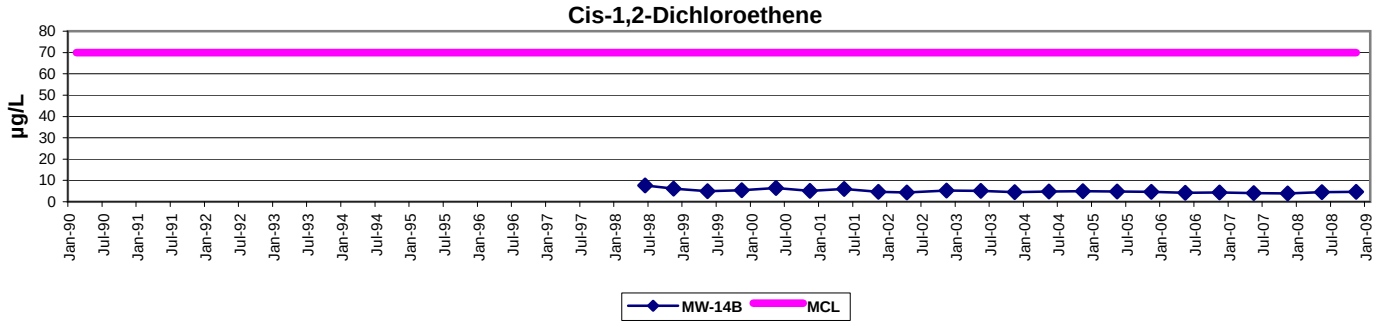


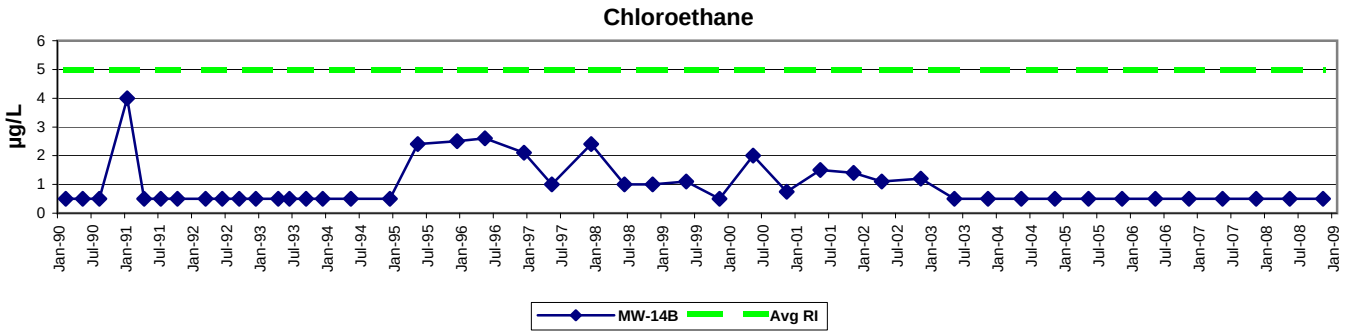
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

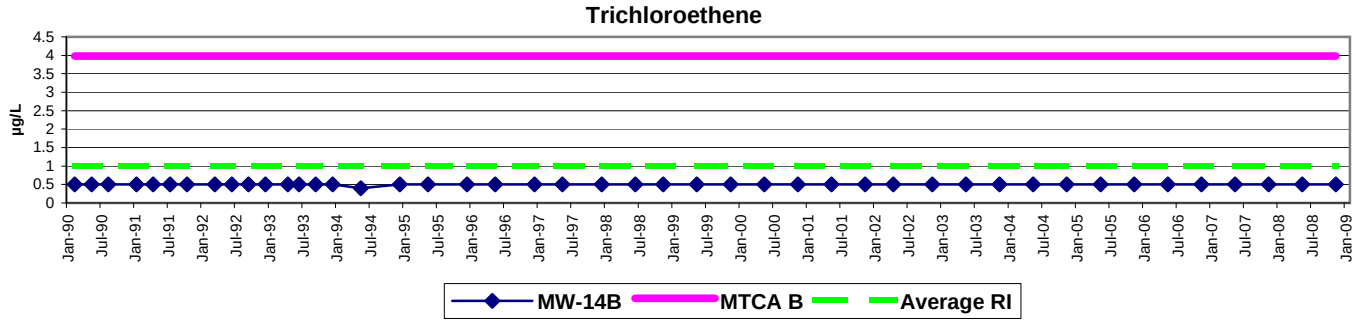
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-14B





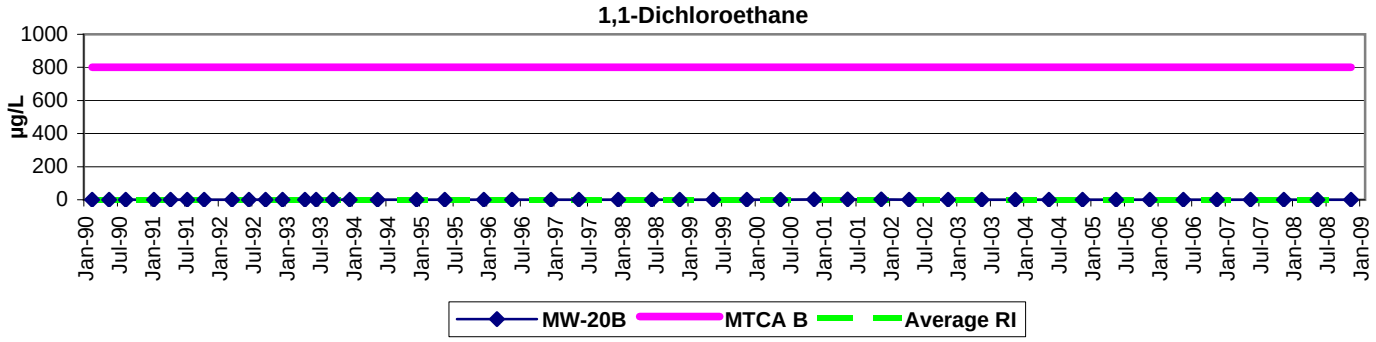


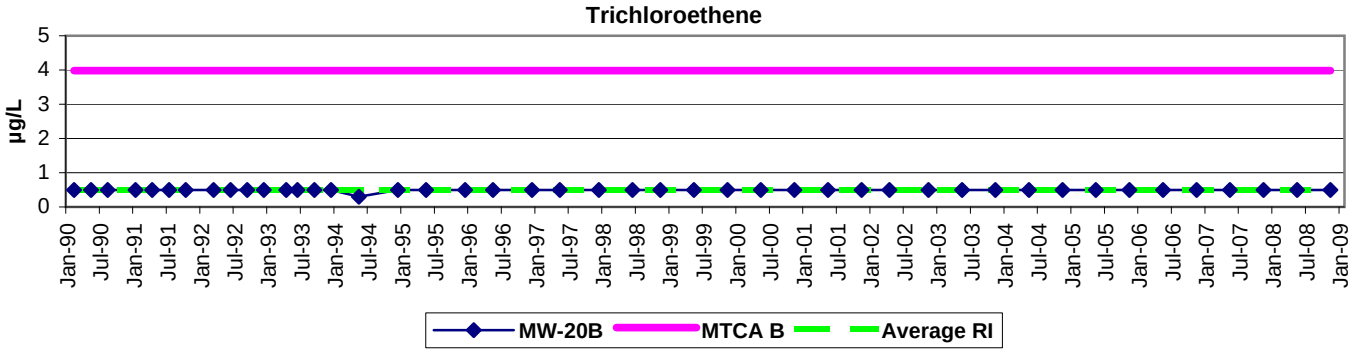


Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-20B

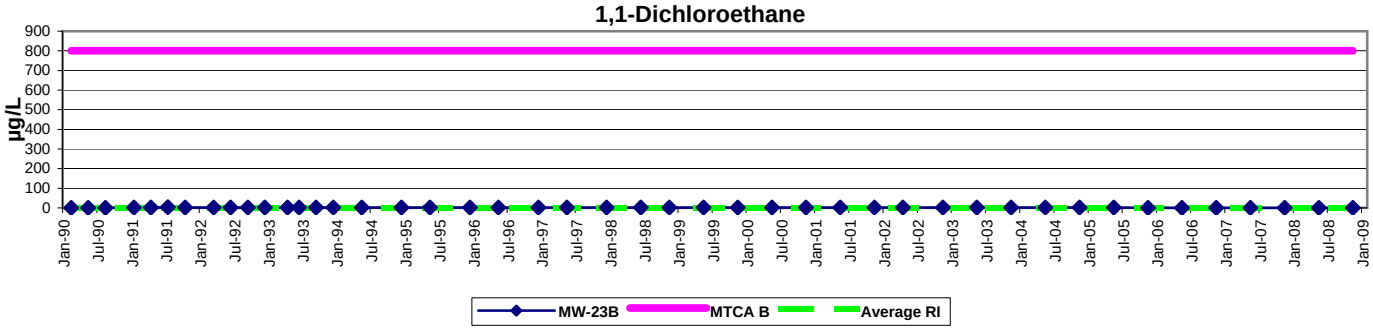


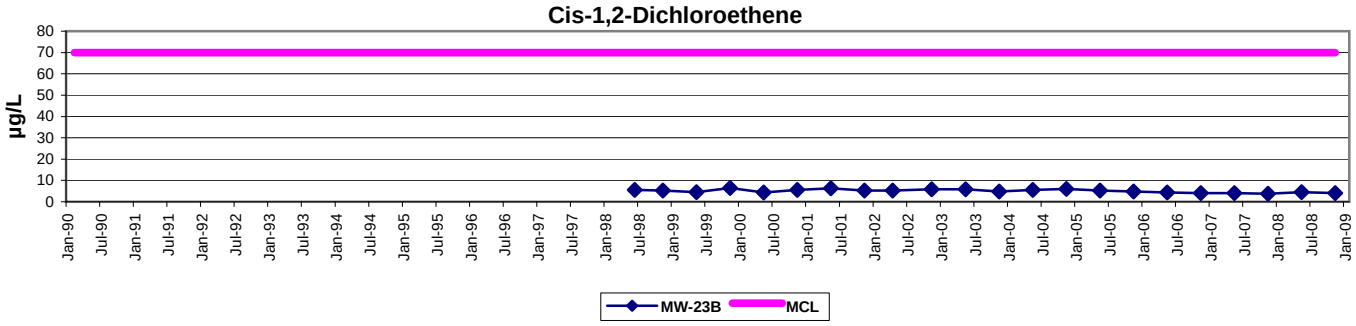


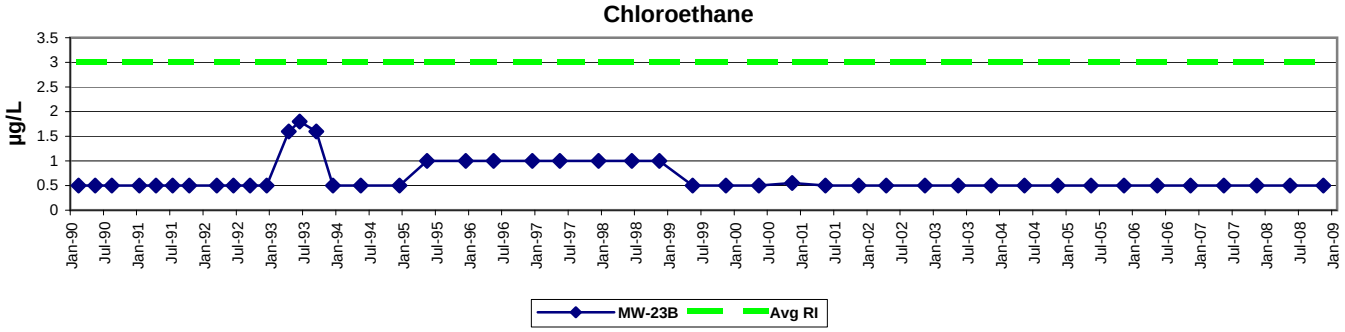
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

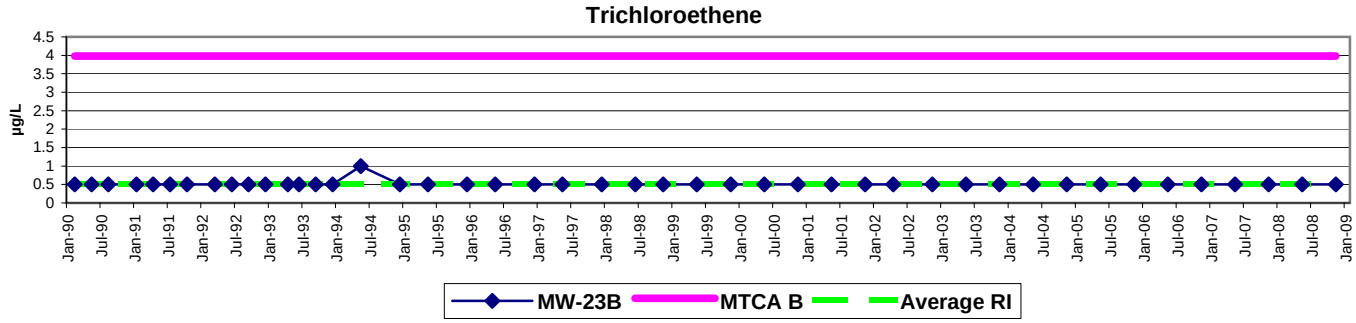
Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-23B









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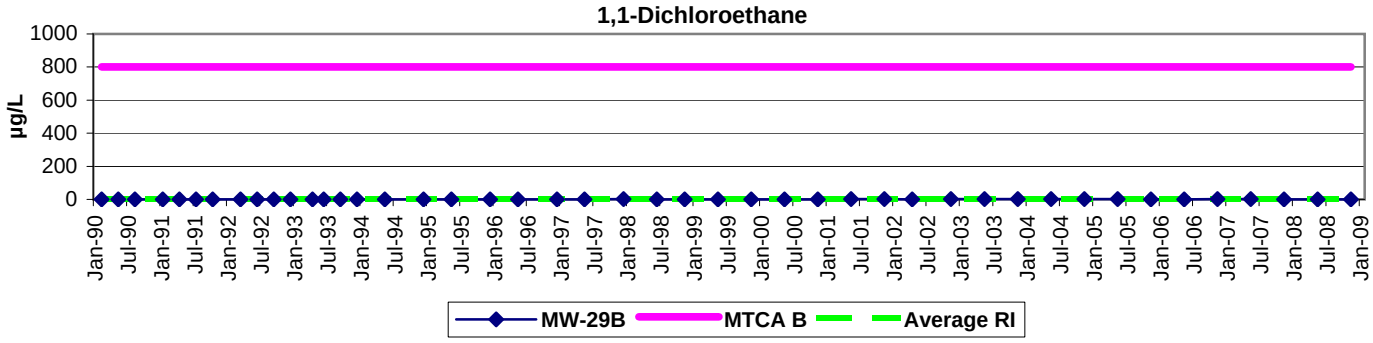
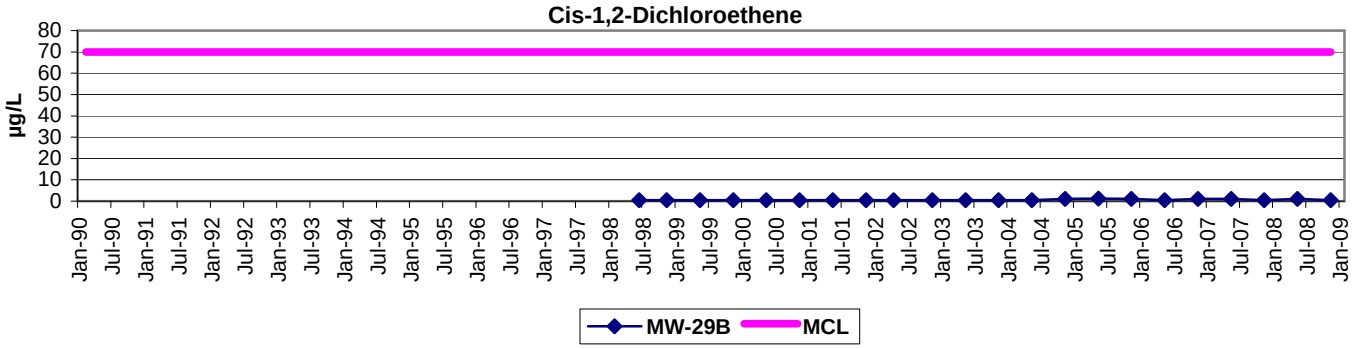
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

Midway Landfill
Groundwater Quality Parameters Not Included in the ROD

Downgradient Southern Gravel Aquifer Well
MW-29B

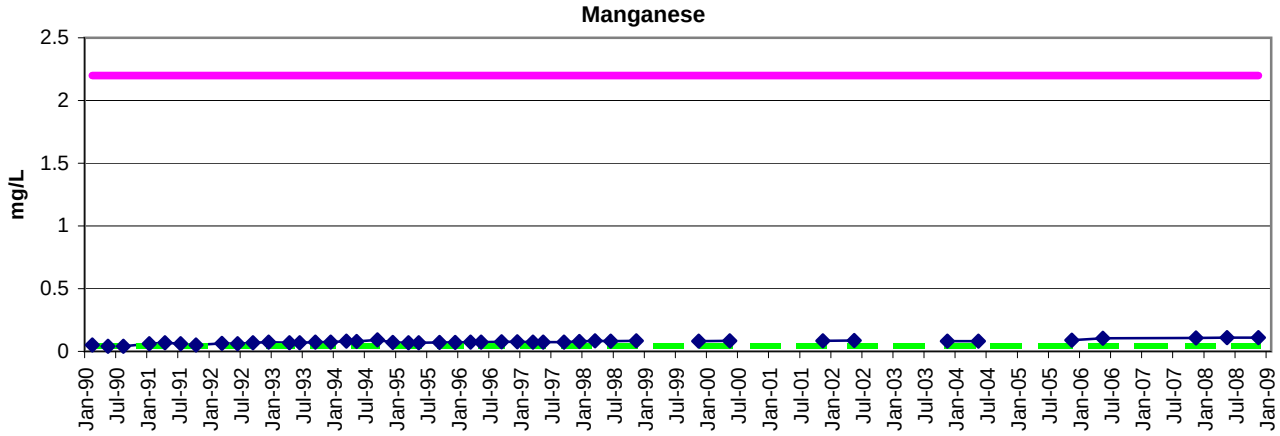


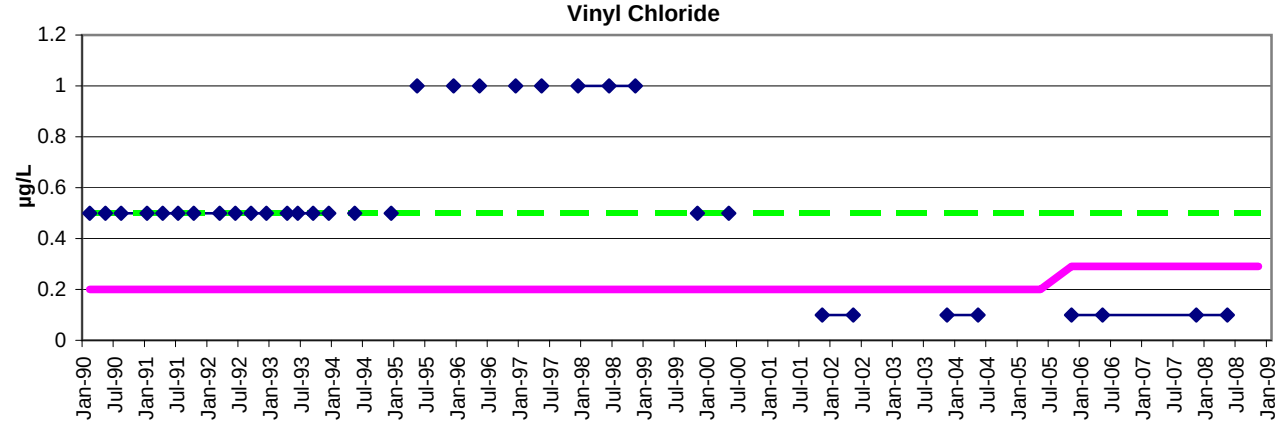


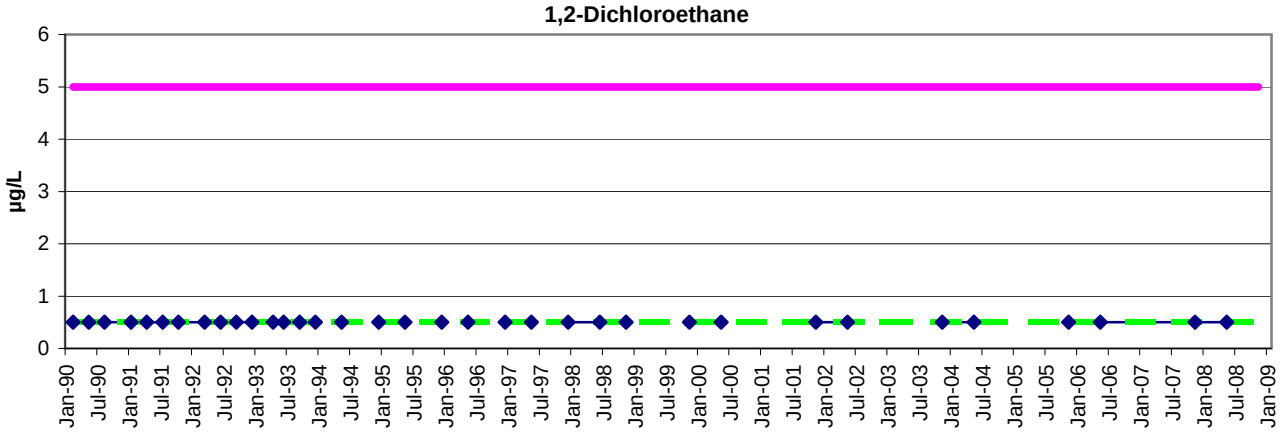
Non-detected values are shown as 1/2 the detection limit.
MCL = Primary of secondary maximum contaminat level standard.
MTCA B = MTCA B/Model Toxics Control Act (WAC 173-340) Method B cleanup level.
RI = Remedial Investigation

Midway Landfill
ROD Contaminants of Concern

Upgradient Upper Gravel Aquifer Well
MW-16



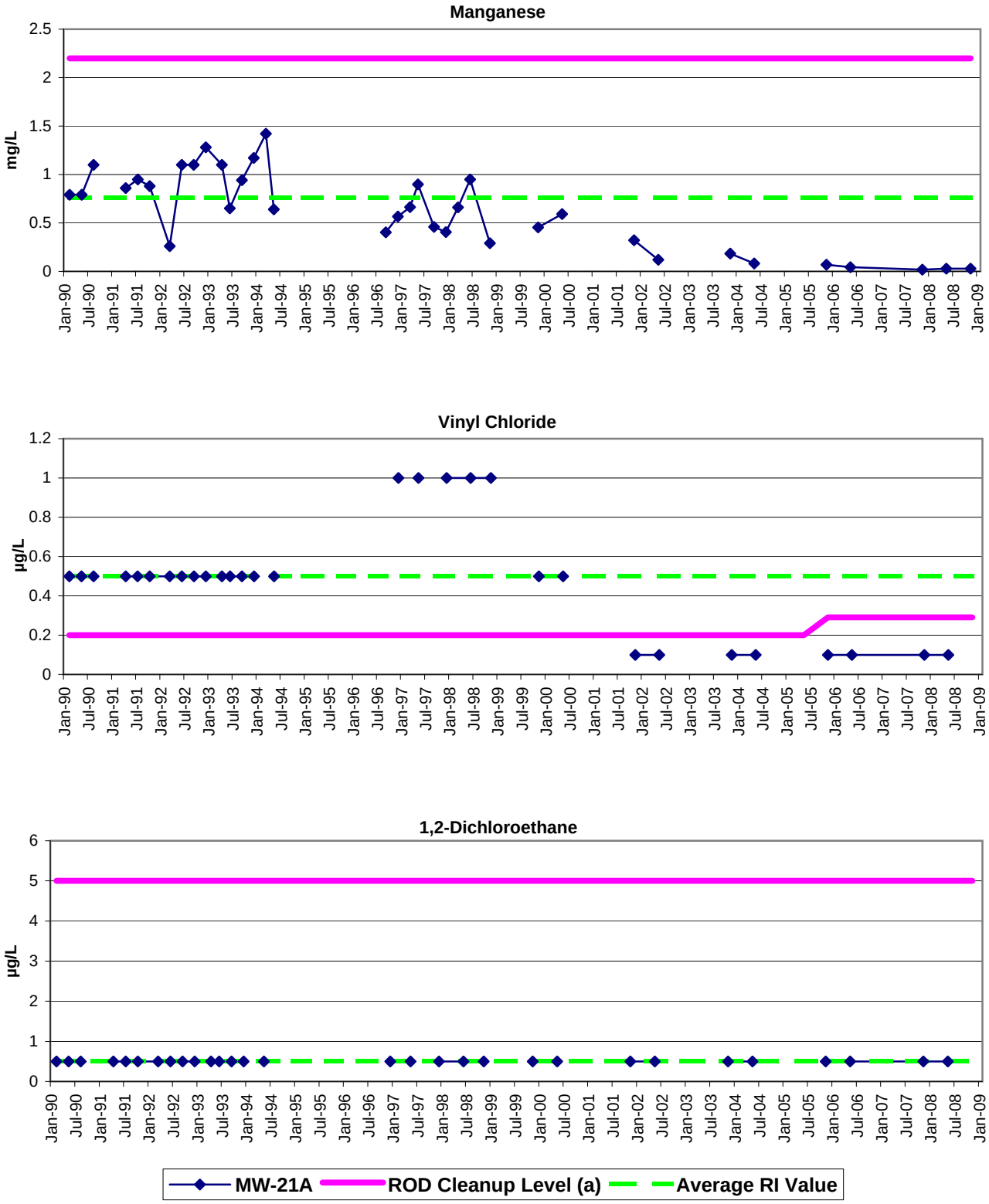




(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
RI = Remedial Investigation

Midway Landfill
ROD Contaminants of Concern

Upgradient Upper Gravel Aquifer Well
MW-21A



(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
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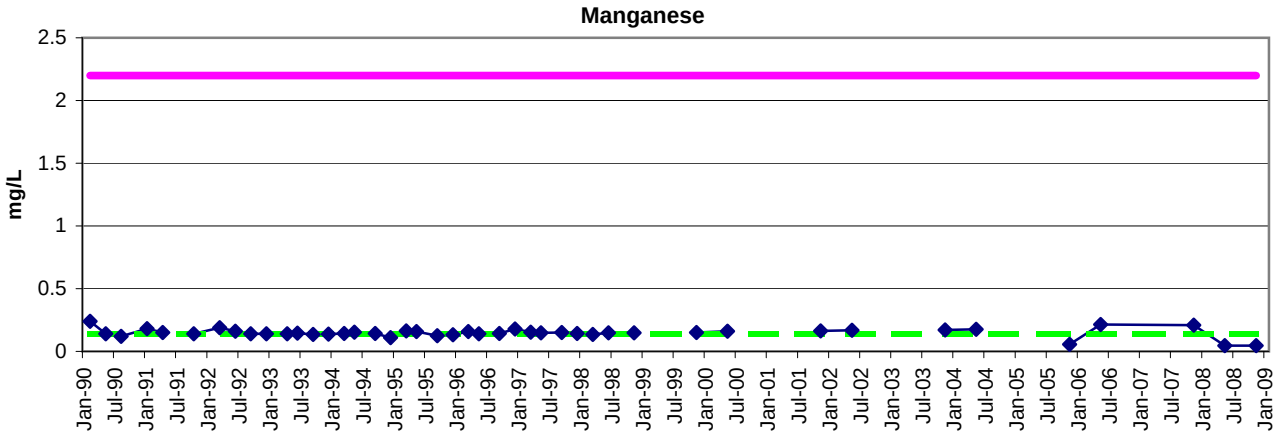
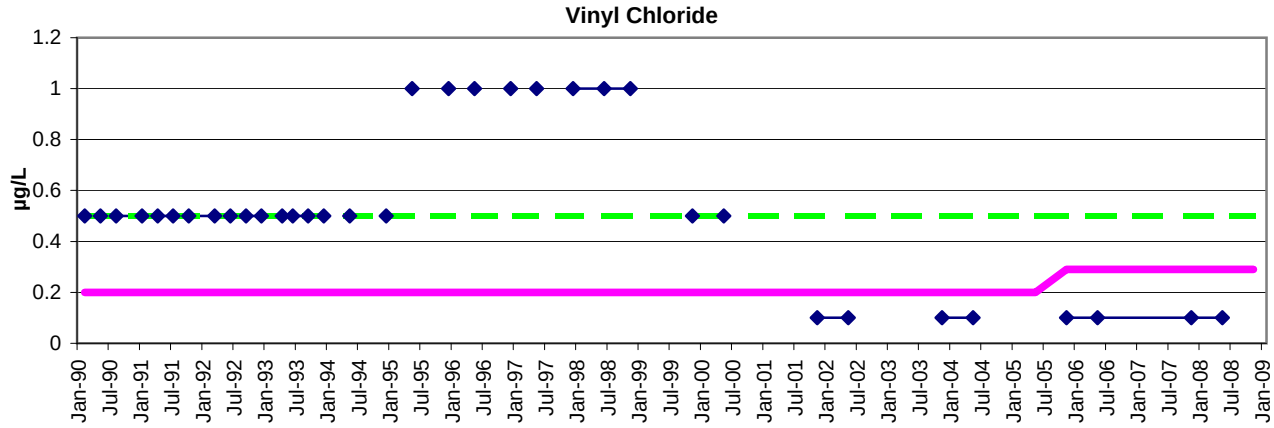
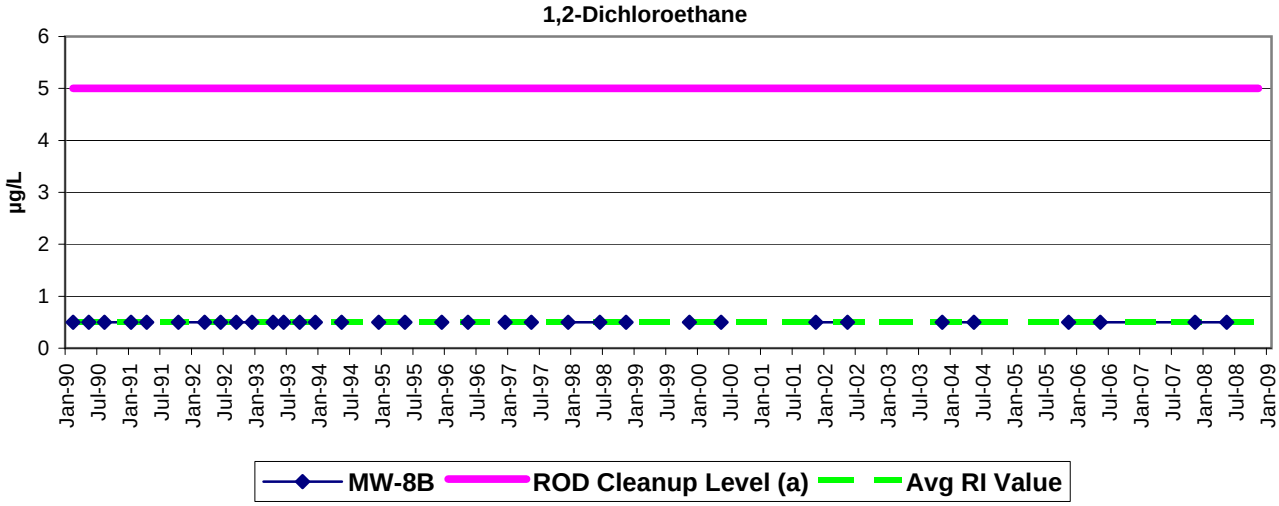
Midway Landfill
ROD Contaminants of Concern

Upgradient Sand Aquifer Well
MW-8B







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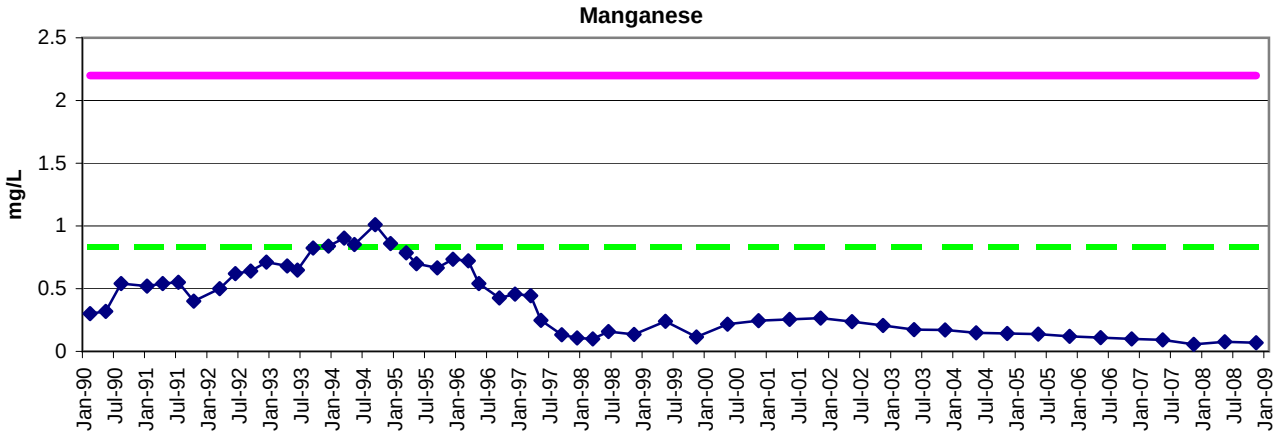
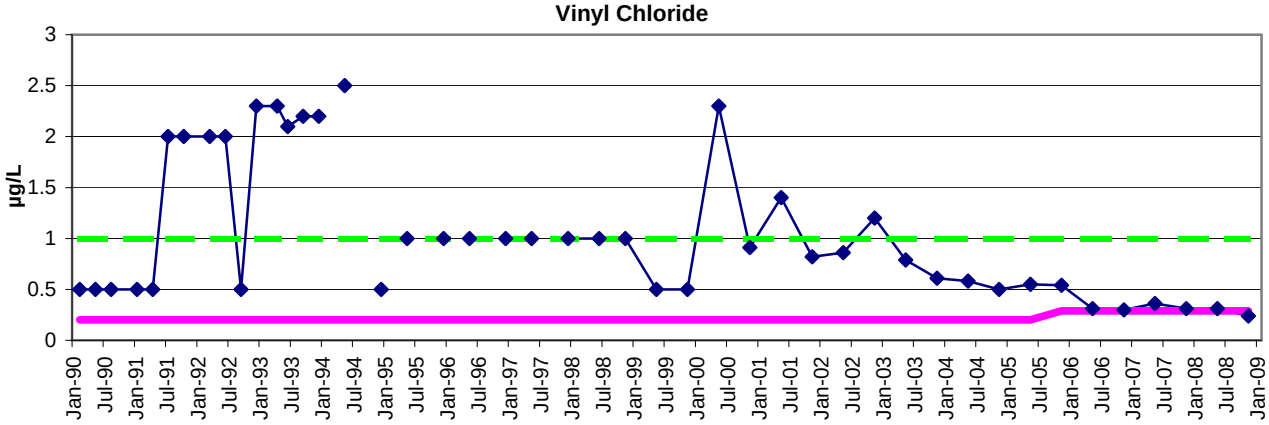
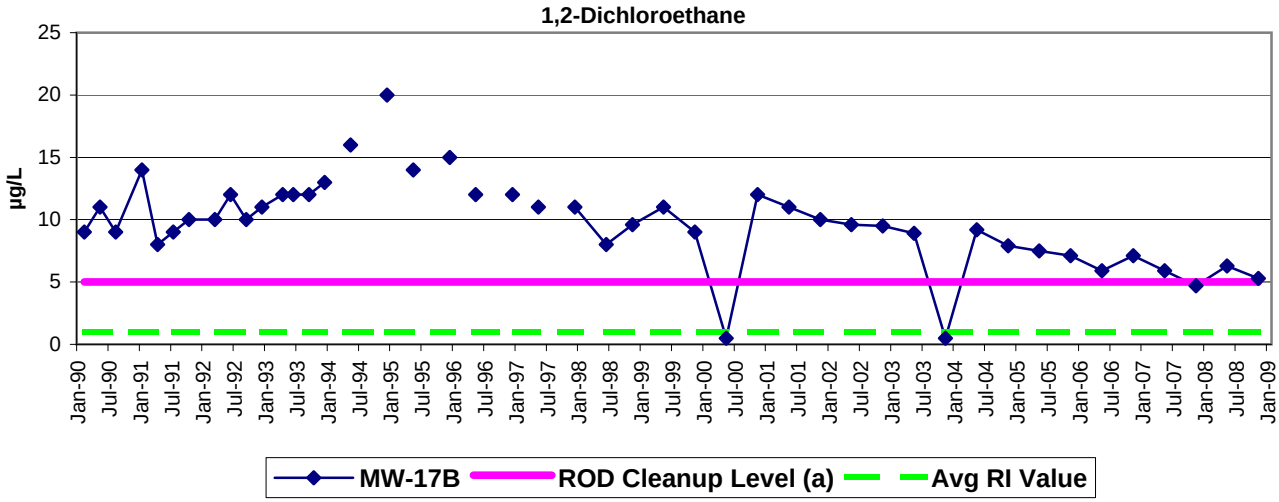
Midway Landfill
ROD Contaminants of Concern

Upgradient Sand Aquifer Well
MW-17B







(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
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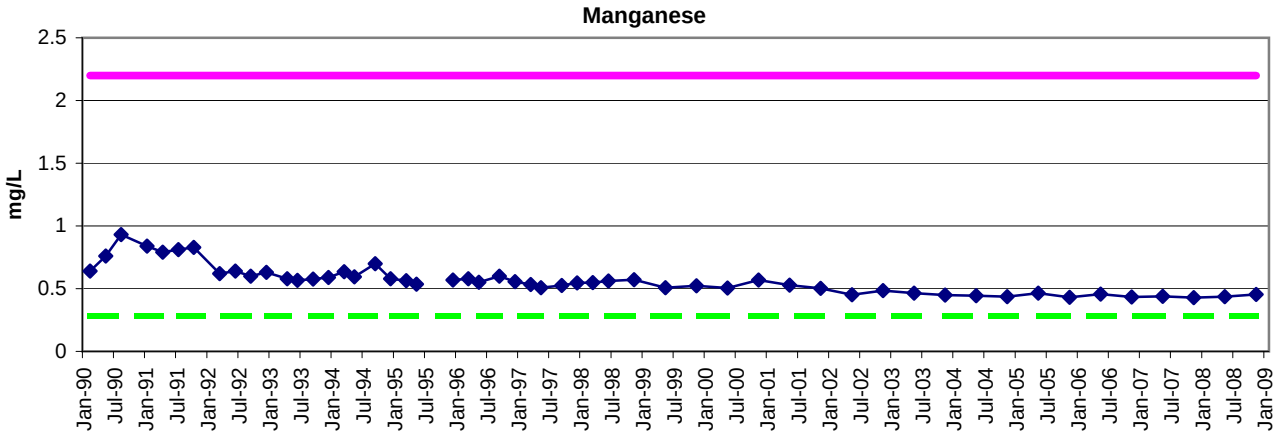
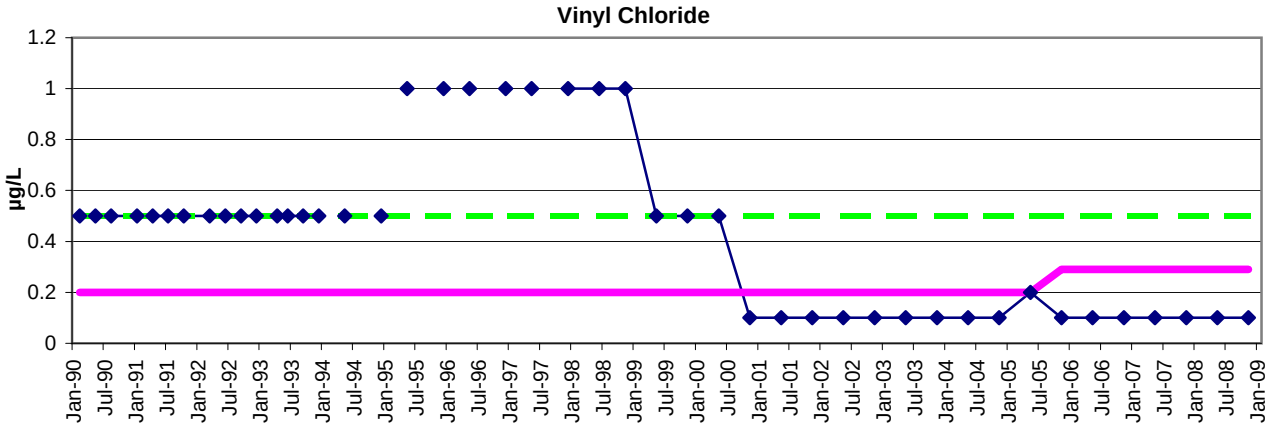
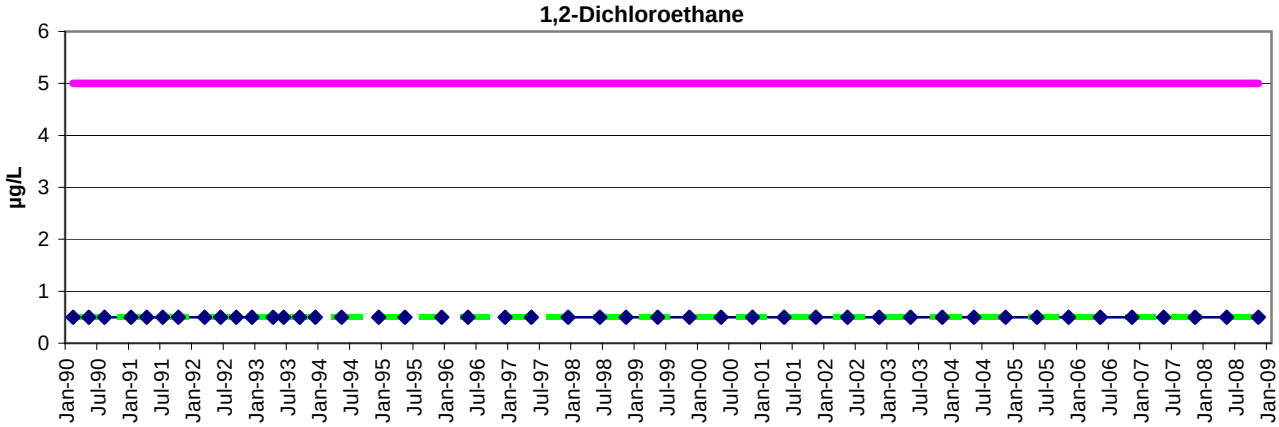
Midway Landfill
ROD Contaminants of Concern

Upgradient Sand Aquifer Well
MW-21B





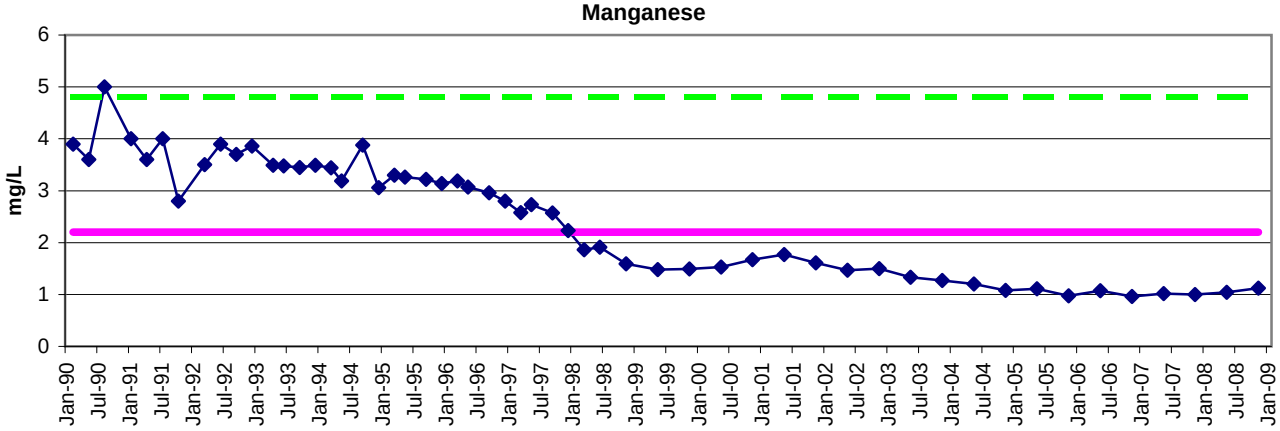


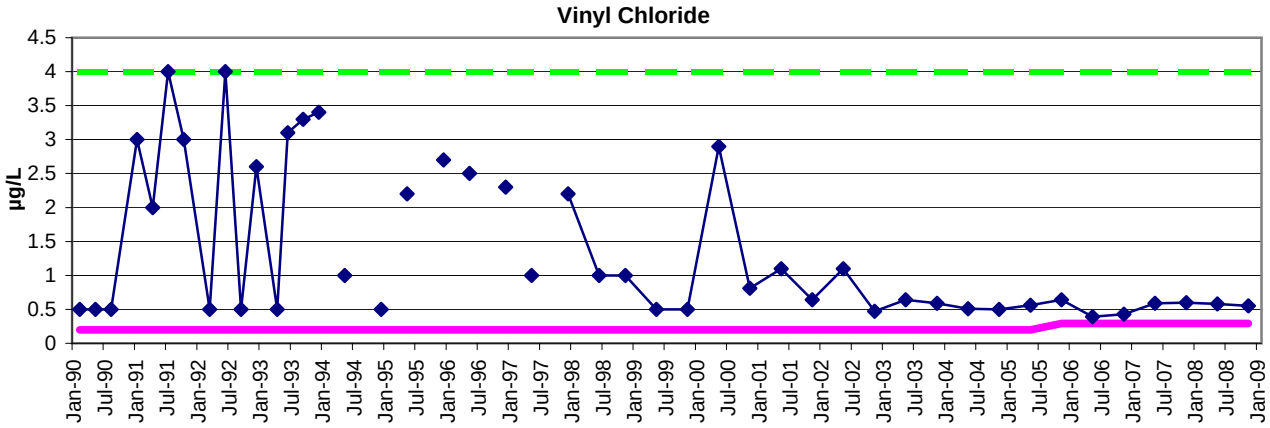
MW-21B **ROD Cleanup Level (a)** **Avg RI Value**

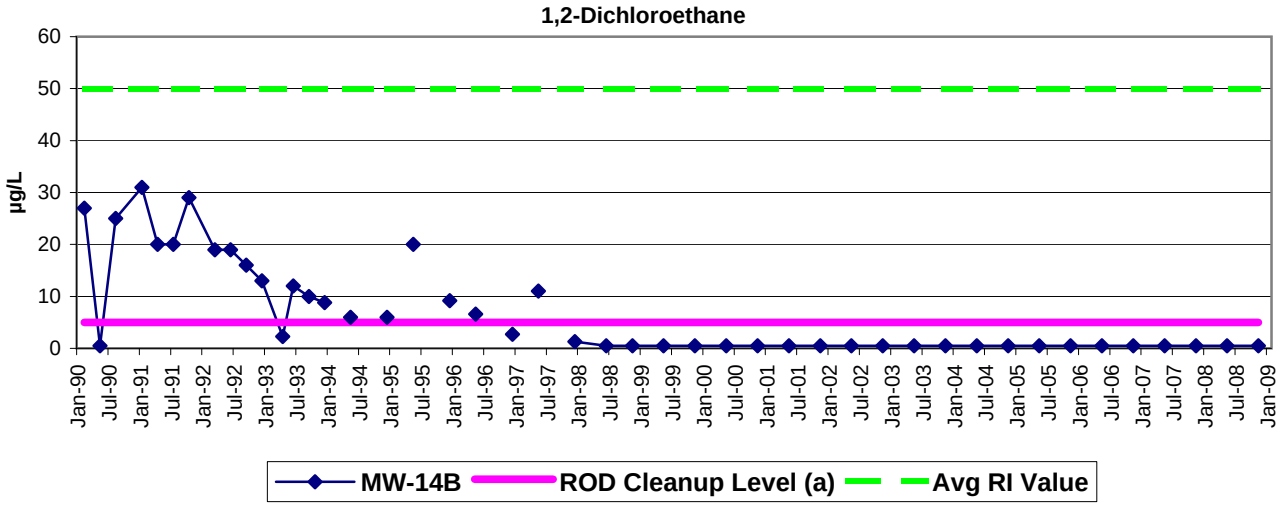
(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
RI = Remedial Investigation

Midway Landfill
ROD Contaminants of Concern

Downgradient Southern Gravel Aquifer Well
MW-14B



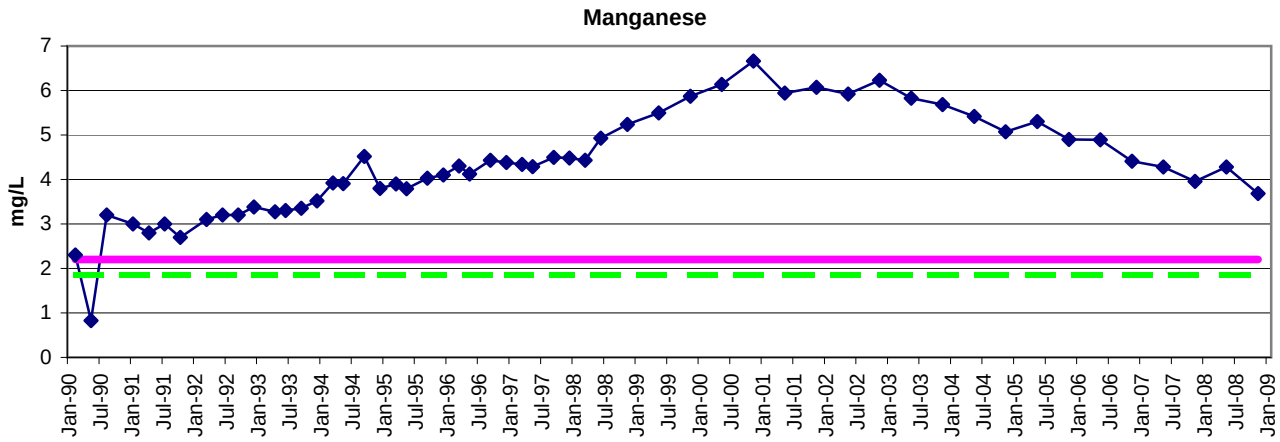


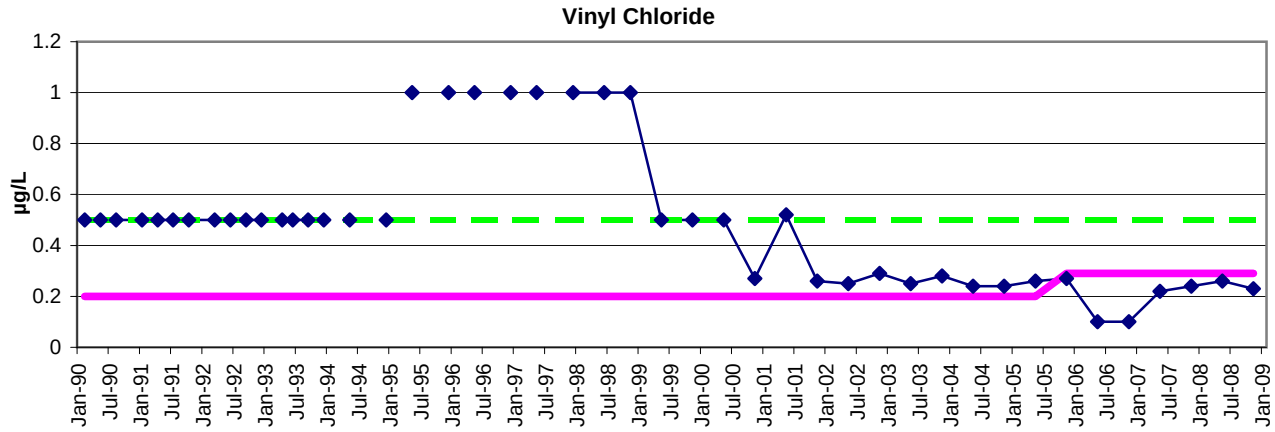


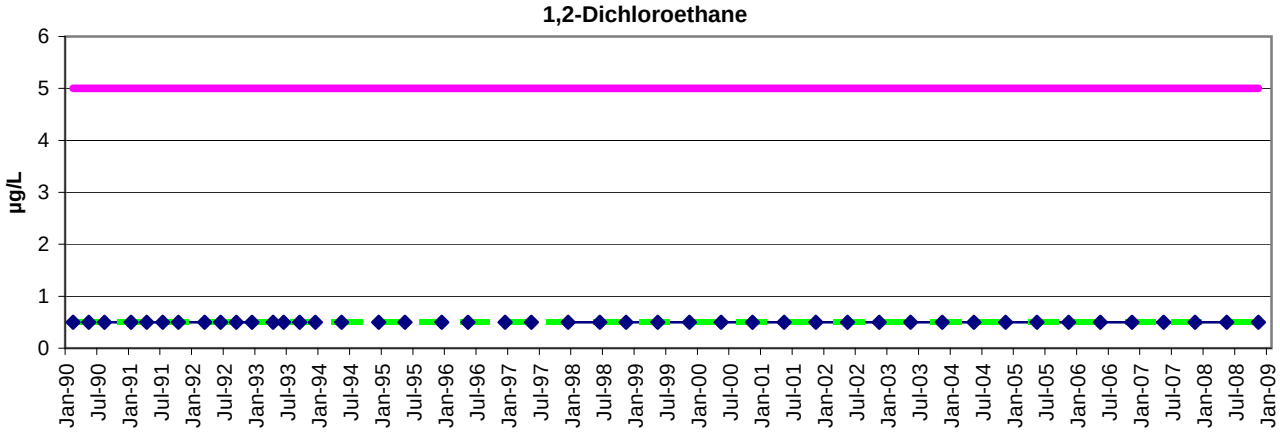
(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
RI = Remedial Investigation

Midway Landfill
ROD Contaminants of Concern

Downgradient Southern Gravel Aquifer Well
MW-20B





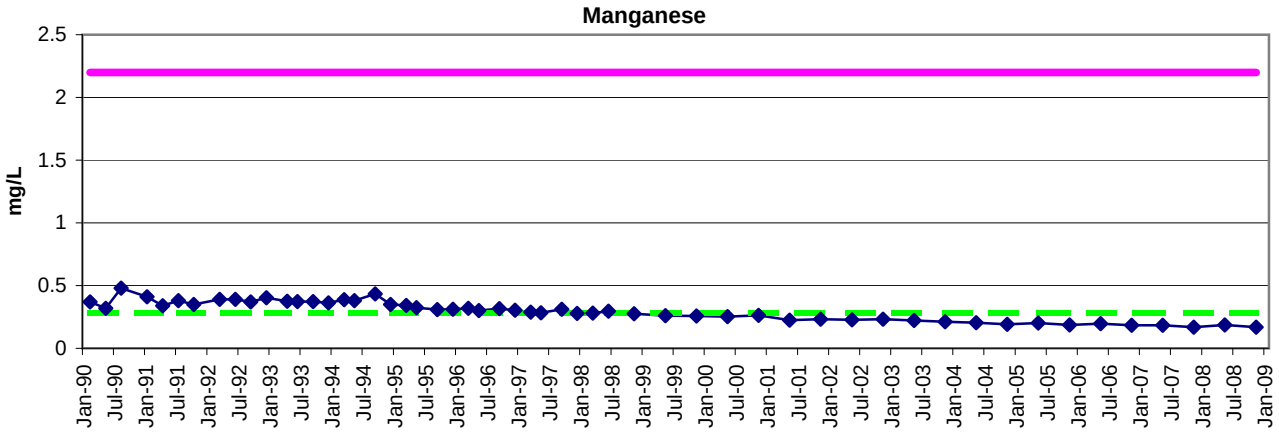


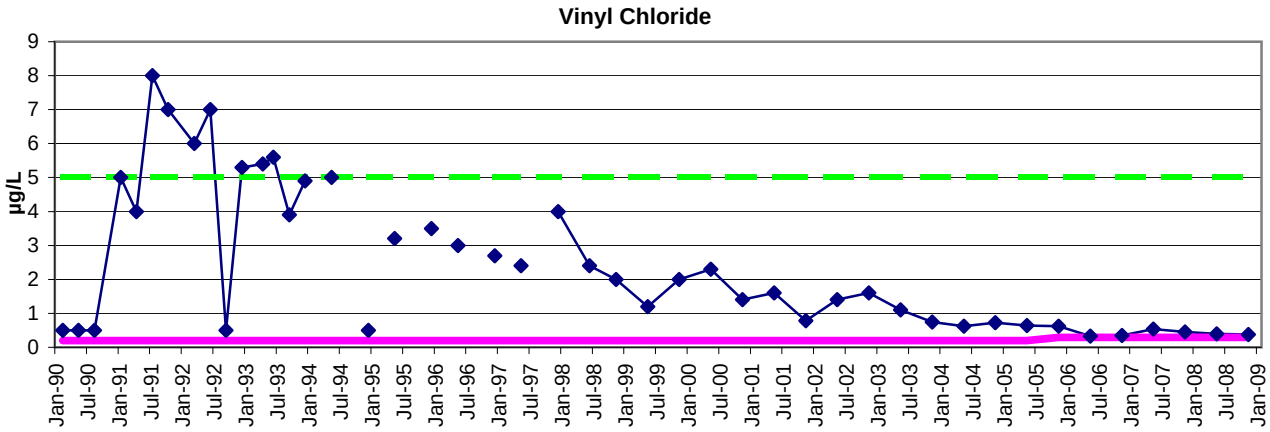
MW-20B **ROD Cleanup Level (a)** **Avg RI Value**

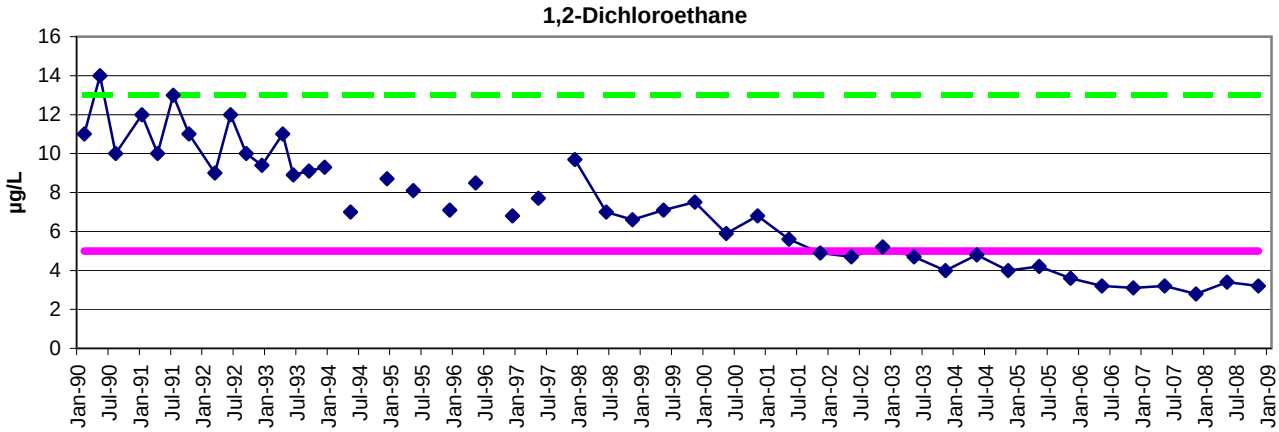
(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
RI = Remedial Investigation

Midway Landfill
ROD Contaminants of Concern

Downgradient Southern Gravel Aquifer Well
MW-23B







MW-23B — **ROD Cleanup Level (a)** — **Avg RI Value**

(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
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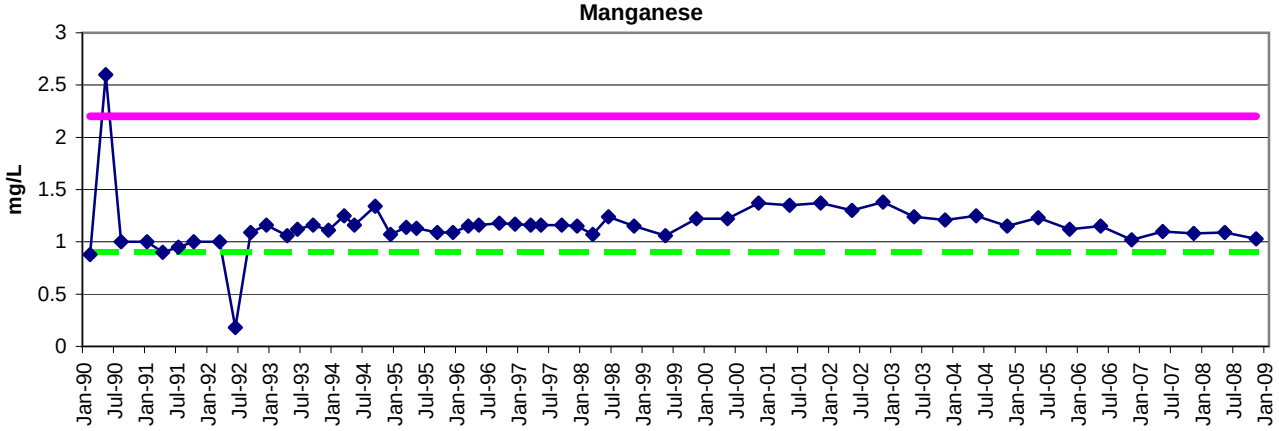
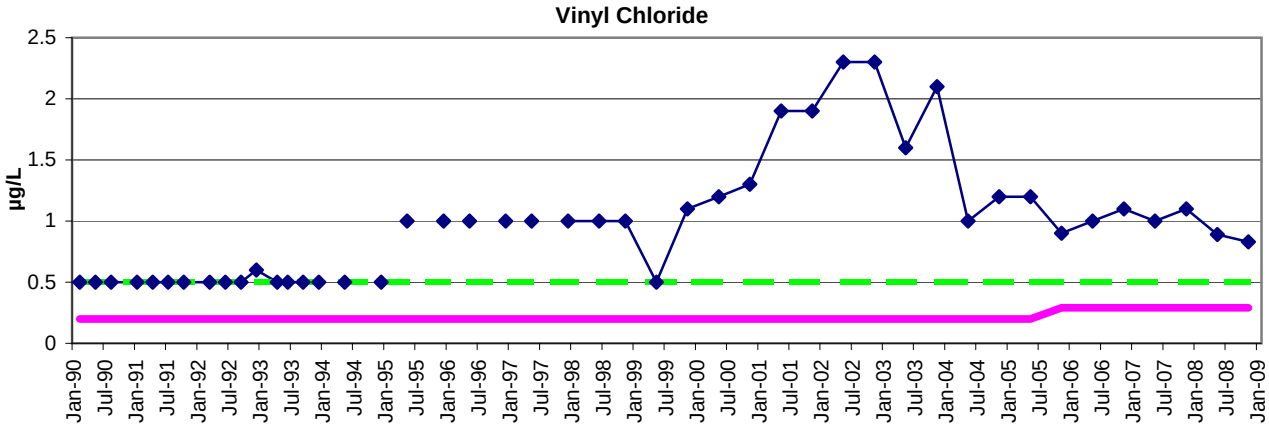
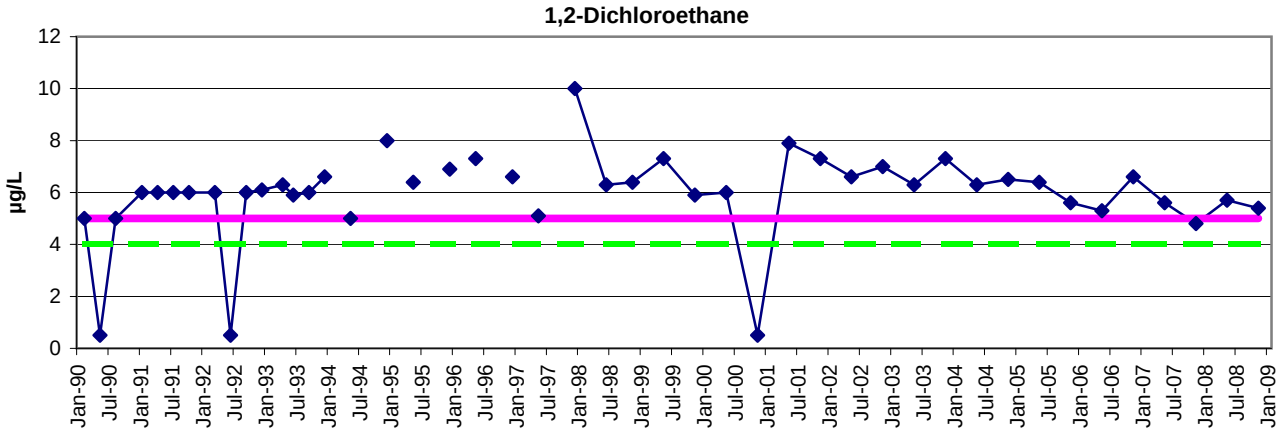
Midway Landfill
ROD Contaminants of Concern

Downgradient Southern Gravel Aquifer Well
MW-29B





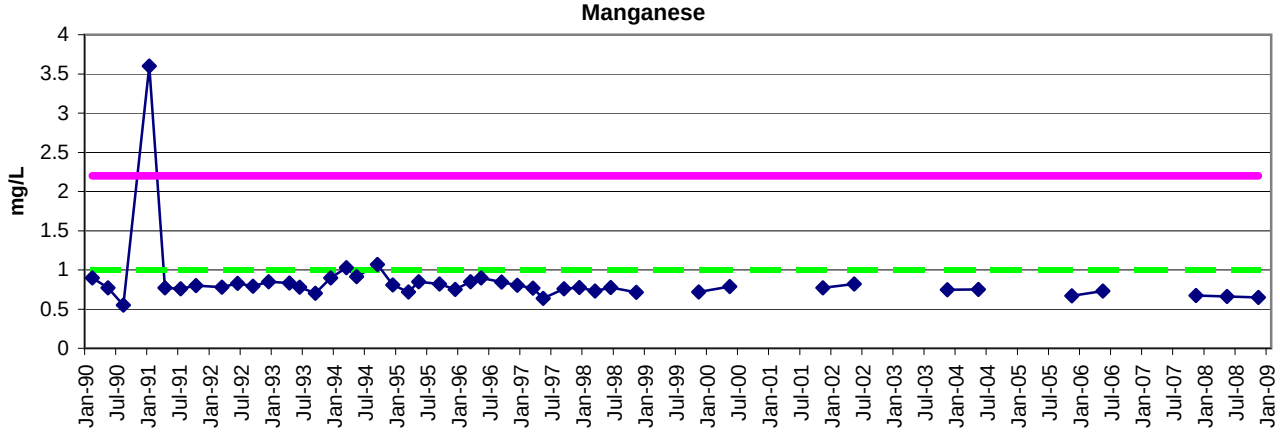


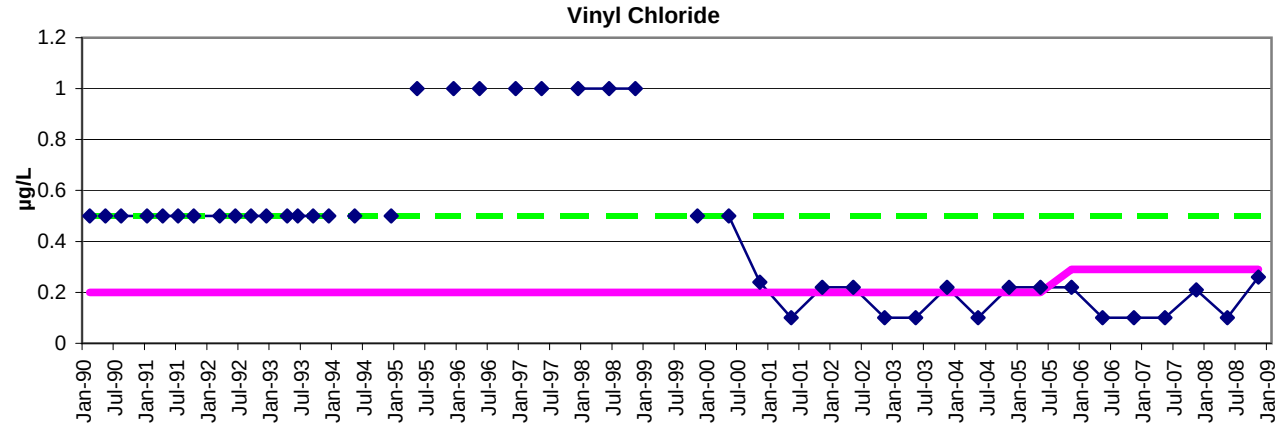
MW-29B — ROD Cleanup Level (a) — Avg RI Value

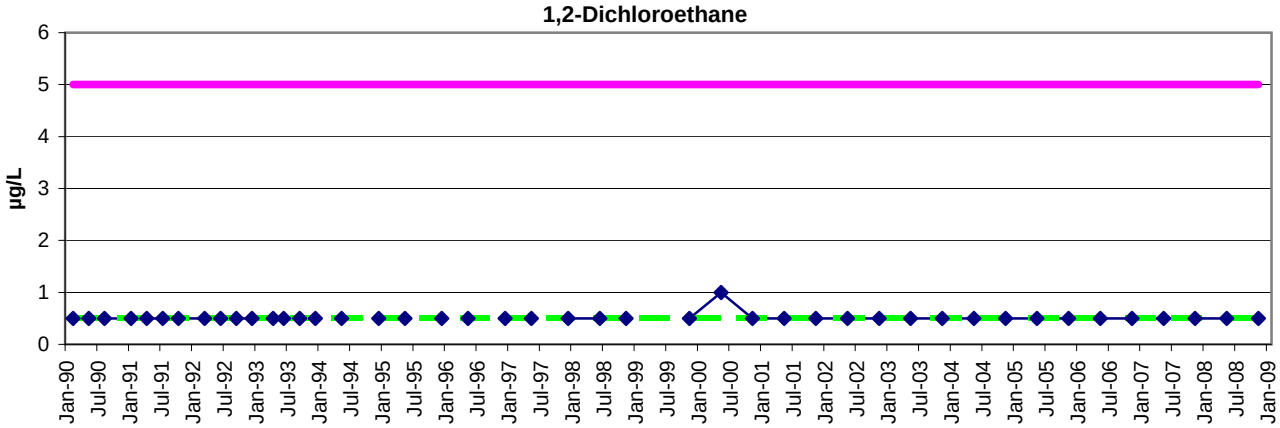
(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
RI = Remedial Investigation

Midway Landfill
ROD Contaminants of Concern

Downgradient Southern Gravel Aquifer Well
MW-30C

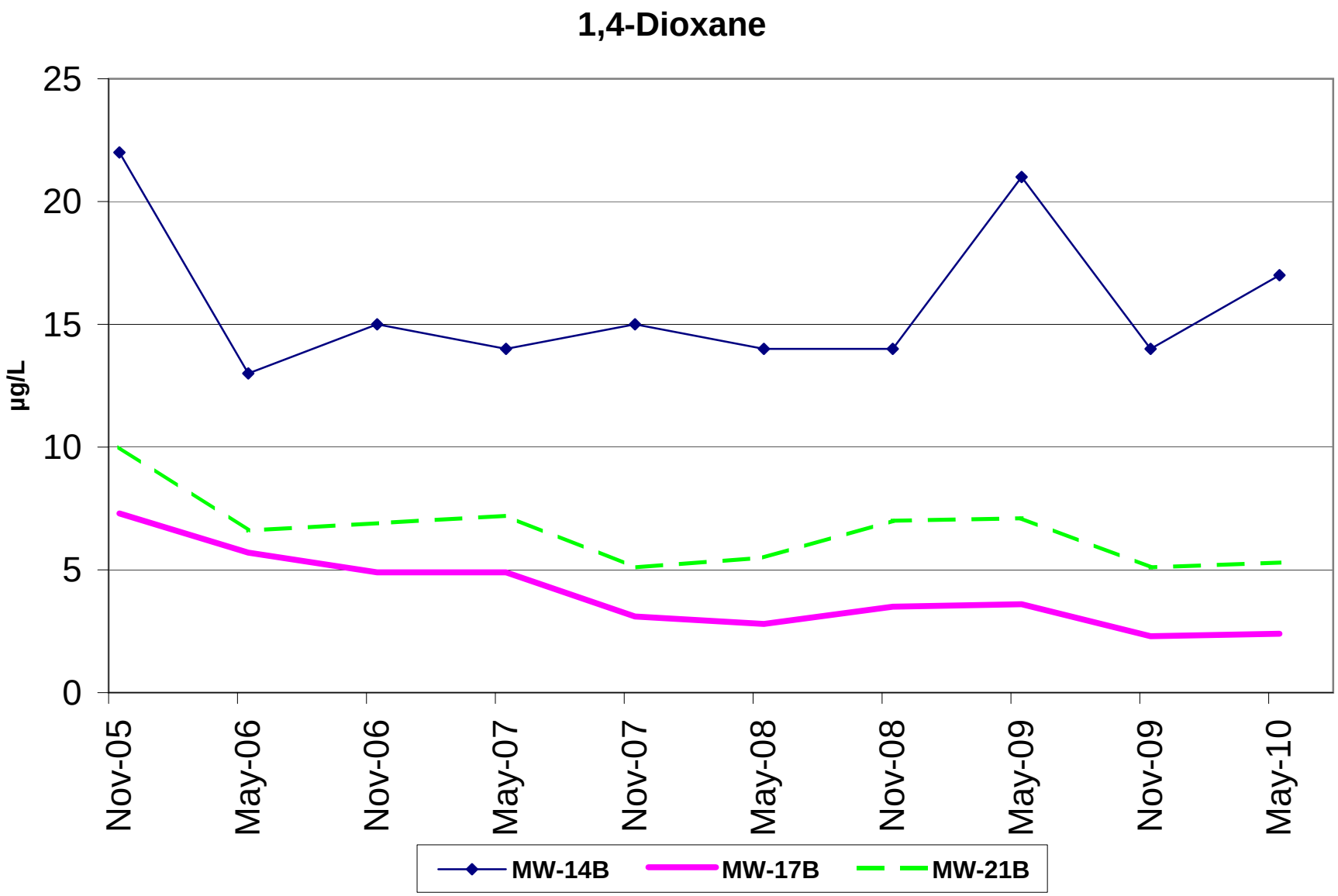






MW-30C — **ROD Cleanup Level (a)** — **Avg RI Value**

(a) Cleanup level established in the final EPA Record of Decision for the Midway Landfill, September 6, 2000.
Non-detected values are shown as 1/2 the detection limit.
RI = Remedial Investigation



Midway Landfill

555-1550-054
6/30/2010

City of Seattle
Seattle Public Utilities

June 28, 2010

Ching-Pi Wang
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue S. E.
Bellevue, WA 9B008-5452

RE: Midway Landfill Annual Groundwater Conditions Report

Dear Mr. Wang:

Enclosed is the annual notice of groundwater conditions in affected areas down-gradient of the Midway Landfill for 2008. This is being sent to you pursuant to the requirements in the Midway Landfill Record of Decision (ROD) between the City of Seattle and the United States Environmental Protection Agency. The 2009 report will be sent in early fall 2010.

If you have any questions or require additional information, please contact me at jeff.neuner@seattle.gov or at 206-684-7693.

Sincerely,

Jeff Neuner
Midway Landfill Manager

Enclosure

CC: Ed Davis, Public Health Seattle King County
Highline Water District
Lakehaven Utility District
Active Well Drillers in King County
(Washington State Department of Ecology list)
Owner of Well 37

Ray Hoffman, Director
Seattle Public Utilities
700 5th Avenue, Suite 4900
PO Box 34018
Seattle, WA 98124-4018

Tel (206) 684-5851
Fax (206) 684-4631
TDD (206) 233-7241
ray.hoffman@seattle.gov

http://www.seattle.gov/util
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Annual Notice of Groundwater Conditions in Affected Areas Downgradient of the Midway Landfill[1]

The City of Seattle is the owner and previous operator of the Midway Landfill, located north of South 252nd Street between SR-99 and I-5 in Kent, Washington (Figure 1).

Extensive testing of groundwater within and surrounding the landfill area has indicated the presence of various contaminants that do not meet federal drinking water standards (MCLs) or state groundwater standards (MTCA Method B cleanup levels). The affected groundwater monitoring wells downgradient of the Midway Landfill are listed in Table 1 and their locations are shown in Figure 2. A summary of the contaminants of concern and their reported concentrations in groundwater are presented in Table 2. A summary of results for additional parameters is presented in Table 3.

In compliance with a Consent Decree between the City of Seattle and the Washington State Department of Ecology (Ecology), and in accordance with a Record of Decision between the City of Seattle and the United States Environmental Protection Agency (U.S. EPA), Ecology and all appropriate local health districts, water districts, and certified well drillers are hereby notified that no water supply wells are to be constructed or used in the areas of known groundwater contamination listed in Table 1 and shown on Figure 2.

This is an annual notification.

Table 1. Affected Groundwater Monitoring Wells Downgradient of the Midway Landfill

Monitoring Well	Land Surface Elevation	Elevation of Screened Interval	Aquifer
MW-14B	381.0	79 - 73.5	SGA
MW-20B	373.7	78.7 - 73.7	SGA
MW-23B	425.0	104.7 - 94.7	SGA
MW-29B	428.8	58.9 - 51.9	SGA
MW-30C	407.5	61.8 - 56.8	SGA

Notes:

SGA - Southern Gravel Aquifer

[1] The City will annually notify the Seattle-King County Department of Public Health, Ecology, the local water districts, and locally active well drillers in writing of groundwater conditions in the affected areas downgradient of the landfill.

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Midway	**Date of inspection:** 6·29·10
Location and Region: EPA ECL R10	**EPA ID:**
Agency, office, or company leading the five-year review: EPA	**Weather/temperature:** Cloudy to partly sunny 55-65°F

Remedy Includes: (Check all that apply)

- Landfill cover/containment ✓
- Access controls ✓
- Institutional controls ✓
- Groundwater pump and treatment
- Surface water collection and treatment ✓
- Monitored natural attenuation ✓
- Groundwater containment
- Vertical barrier walls
- Other _____

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Jeff Neuner _____ 6·29·10
   Name Title Date
   Interviewed (at site) at office by phone Phone no. _____
   Problems, suggestions; Report attached _____

2. **O&M staff** Min-Sam Yim Senior Environmental Analyst 6·29·10
   Name Title Date
   Interviewed (at site) at office by phone Phone no. _____
   Problems, suggestions; Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency WA Dept of Ecology
Contact Chung-Pi Wang Project Manager 4.30.10
Name Title Date Phone no.
Problems; suggestions; Report attached

Agency
Contact
Name Title Date Phone no.
Problems; suggestions; Report attached

Agency
Contact
Name Title Date Phone no.
Problems; suggestions; Report attached

Agency
Contact
Name Title Date Phone no.
Problems; suggestions; Report attached

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available ✓	Up to date ✓	N/A
	As-built drawings	Readily available ✓	Up to date ✓	N/A
	Maintenance logs	Readily available ✓	Up to date ✓	N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	Readily available ✓	Up to date ✓	N/A
	Contingency plan/emergency response plan	Readily available ✓	Up to date ✓	N/A
	Remarks			
3.	**O&M and OSHA Training Records**	Readily available ✓	Up to date ✓	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available ✓	Up to date ✓	N/A
	Effluent discharge	Readily available	Up to date	N/A ✓
	Waste disposal, POTW	Readily available	Up to date	N/A ✓
	Other permits	Readily available	Up to date	N/A ✓
	Remarks Puget Sound Clean Air Agency Permit			
5.	**Gas Generation Records**	Readily available ✓	Up to date ✓	N/A
	Remarks			
6.	**Settlement Monument Records**	Readily available ✓	Up to date ✓	N/A
	Remarks Well head surveys performed every 5 years, field observations regularly			
7.	**Groundwater Monitoring Records**	Readily available ✓	Up to date ✓	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other City of Seattle in house and with contracter

2. **O&M Cost Records**

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate $432,000 - $535,000 annually Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
1/10	6/10	$121,219	Breakdown attached
1/09	12/09	$260,877	Breakdown attached
1/08	12/08	$262,774	Breakdown attached
1/07	12/07	$303,065	Breakdown attached
1/06	12/06	$332,366	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured ✓ — N/A

Remarks Fencing in good condition, gates locked

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A

Remarks Signs in good condition

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) monthly full walk down/daily drive through
Frequency
Responsible party/agency City of Seattle
Contact Jeff Neiner

Name	Title	Date	Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks minimum, has been repaired when occurs

2. **Land use changes on site** N/A
Remarks

3. **Land use changes off site** N/A
Remarks Lowes replaced drive-in ~1 block N of site

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks

B. Other Site Conditions

Remarks mower in progress to keep vegetation from establishing deep root & fire prevention & inspection access

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent ____ Depth ~10-13' total in ~20 yrs
Remarks ~2' in last 5 years (0-2')

2. **Cracks** Location shown on site map Cracking not evident
Lengths ____ Widths ____ Depths ____
Remarks ____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent ____ Depth ____
Remarks ____

4. **Holes** Location shown on site map Holes not evident
Areal extent ____ Depth ____
Remarks ____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks ____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks ____

7. **Bulges** Location shown on site map Bulges not evident
Areal extent ____ Height ____
Remarks ____

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
Wet areas Location shown on site map Areal extent_____
Ponding Location shown on site map Areal extent_____
Seeps Location shown on site map Areal extent_____
Soft subgrade Location shown on site map Areal extent_____
Remarks Minor wet area draining towards retention pond

9. **Slope Instability** Slides Location shown on site map No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches Applicable N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
Remarks_____

2. **Bench Breached** Location shown on site map N/A or okay
Remarks_____

3. **Bench Overtopped** Location shown on site map N/A or okay
Remarks_____

C. Letdown Channels Applicable N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** Location shown on site map No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** Location shown on site map No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** Location shown on site map No evidence of undercutting ✓
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ No obstructions ✓
Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks_____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A ✓
Remarks_____

5. **Settlement Monuments** Located Routinely surveyed N/A ✓
Remarks_____

E. Gas Collection and Treatment Applicable N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks Condensate to sanitary sewer

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks

2. **Outlet Rock Inspected** Functioning N/A
   Remarks

G. Detention/Sedimentation Ponds Applicable N/A

1. **Siltation** Areal extent_____ Depth_____ N/A
   Siltation not evident
   Remarks wetland to decrease turbidity working

2. **Erosion** Areal extent_____ Depth_____
   Erosion not evident
   Remarks

3. **Outlet Works** Functioning N/A
   Remarks

4. **Dam** Functioning N/A
   Remarks

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____

2. **Degradation** Location shown on site map Degradation not evident N/A
Remarks_____

I. Perimeter Ditches/Off-Site Discharge Applicable N/A

1. **Siltation** Location shown on site map Siltation not evident
Areal extent_____ Depth_____
Remarks_____

2. **Vegetative Growth** Location shown on site map N/A
Vegetation does not impede flow
Areal extent_____ Type_____
Remarks_____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Discharge Structure** Functioning N/A
Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable N/A

1. **Settlement** Location shown on site map Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Performance Monitoring** Type of monitoring_____
Performance not monitored
Frequency_____ Evidence of breaching
Head differential_____
Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent)_____
   Others_____
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually_____
   Quantity of surface water treated annually_____
   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time ✓ Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining ✓

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled ✓ Good condition ✓
   All required wells located Needs Maintenance N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

SITE INSPECTION PHOTOGRAPHS

Linda Heights Park storm water diversion mechanical room.

Linda Heights Park storm water diversion pumps.

Gas extraction system mechanical room.

Gas extraction system flares. Current flare on left, backup flare on right.

Retention pond drainage.

Retention pond.

Landfill cover.

Cutting of the landfill cover vegetation.

Landfill cover with gas extraction system.