King County

Department of Natural Resources and Parks
Solid Waste Division

CEDAR HILLS REGIONAL LANDFILL 2012 GROUNDWATER DATA EVALUATION

APRIL 2013

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EXECUTIVE SUMMARY

This 2012 Groundwater Data Evaluation Annual Report summarizes groundwater data collected in 2012 and presents significant findings supported by the evaluation of this data.

Groundwater at the Cedar Hills Regional Landfill (CHRLF) occurs both in a regional aquifer and in perched zones. The regional aquifer flows through advance outwash and deeper deposits and is separated from the base of waste placement areas by more than 200 feet of unsaturated sands and gravels. Perched groundwater occurs in onsite till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified; leaving the regional aquifer beneath the landfill as the earliest target hydraulic pathway for groundwater contaminant detection.

REGIONAL AQUIFER

The regional aquifer beneath CHRLF is entirely recharged by precipitation. A local recharge area is located immediately south of the landfill within the Queen City Farms (QCF) property, and is centered north of the Main Gravel Pit Lake. In general, groundwater flow in the regional aquifer is radial from the recharge area. Beneath the landfill, regional flow is to the north in the south and central portions of the landfill site. Flow direction in the northern part of the site turns northeasterly as recharge from the McDonald Creek drainage affects flow patterns. Regional Aquifer flow is physically separated from the Cedar River and likely discharges to Issaquah Creek. There is no significant seasonal variation in horizontal groundwater flow paths. Horizontal gradients are influenced by infiltrating precipitation in the recharge area. Vertical hydraulic gradients are demonstrated by head differences in adjacent wells screened at different depths and related to hydraulic conductivity of the aquifer materials. A flow path analysis has been completed for the site and indicates a complex flow regime in the landfill vicinity

A monitoring network is in place consisting of 45 monitoring and production wells. Monitoring network wells are located to characterize groundwater flow and to obtain representative samples for water quality characterization. Downgradient flow converges into a high transmissivity zone which provides excellent monitoring coverage for all flow paths within the potential source area.

An extensive list of chemical analytes and field parameters are analyzed and the results are evaluated by a variety of graphical and statistical methods. The groundwater data analyses presented in this report describe onsite groundwater elevations, flow direction and velocity; and summarizes the evaluation of groundwater quality to determine if chemical concentrations have changed over time or differ between well locations. This report determines if these findings are indicative of impacts to groundwater quality by surface activities.

Upgradient groundwater quality, especially in wells nearest the southern recharge zone, is profoundly affected by conditions and activities that have occurred on the adjoining QCF property. Upgradient groundwater quality manifests a high degree of spatial variation and temporal trends, which are expected given recharge area site history which has included a variety of land uses, investigations and remediation.

As flow continues into areas beneath the landfill footprint changes are discernible as groundwater encounters and equilibrates to different oxidation-reduction conditions, soil gas/groundwater interface conditions and solvent/solute interactions. Flow paths under the footprint and immediately downgradient of waste cells are influenced by landfill gas (LFG) in the unsaturated strata. Flow paths in the north landfill area (aligned along MW-66, MW-74, MW-75 and MW-91) are notably higher in chloride concentrations. The data are consistent with an input from onsite, overlying infrastructure in the north end.

Downgradient groundwater quality also manifests a high degree of spatial variation and temporal trends. Much as recharge effects are dampened with distance from the source, the concentrations of many analytes are attenuated by processes such as dispersion dilution, sorption, and degradation as groundwater flows beneath the landfill. The highest concentrations of certain analytes occur in upgradient wells. Groundwater quality in the regional aquifer leaving the site remains consistent with historical data.

These data indicate that CHRLF acts as an attenuation zone for upgradient impacts, allowing a reduction in the concentration of chlorinated volatile organic compounds (CVOCs).

The regional aquifer is the first continuously saturated zone beneath the landfill and serves as the earliest path for detection monitoring. Recent water quality evaluations of QCF groundwater are available in the *2010 Expanded Hydrogeology Assessment Queen City Farms King County, Washington,* (December 2010) and *Report Evaluation of Remedial Action 10-Year Review Queen City Farms King County, Washington* (2008).

PERCHED ZONES

Perched groundwater occurs in onsite till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified. Recharge is by precipitation with possible hydraulic continuity to surface streams.

Impacts from past landfilling practices have previously been recognized in several perched zone wells. Site improvements and engineered facilities have been effective in reducing contaminant concentrations attributable to past practices. Declining or stable long term trends for many contaminants are apparent in these wells. The influence of landfill gas on groundwater quality continues in east side perched groundwater. Additional investigations are in planning to evaluate residual impacts and make recommendations. Recent findings are available in the Technical Memoranda *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment,* April 2010, and the *East Main Hill Perched Zones*, October 2010.

CEDAR HILLS REGIONAL LANDFILL
2012
GROUNDWATER DATA EVALUATION

1.0 INTRODUCTION

This Cedar Hills Regional Landfill (CHRLF) 2012 Groundwater Data Evaluation report evaluates groundwater monitoring data collected during the past calendar year and summarizes the significant findings supported by these evaluations. This report evaluates water quality in the regional aquifer, which is the first continuously saturated zone beneath the landfill and provides the earliest path for detection monitoring. Water quality in the perched water-bearing zones at CHRLF is also evaluated.

Chapter 2 contains a brief description of the geologic and hydrogeologic conditions at CHRLF. For a complete discussion of site conditions, the development of the hydrogeological model and monitoring network, see the *Cedar Hills Regional Landfill Hydrogeologic Report*, March 1999, and the *Cedar Hills Regional Landfill Sitewide Hydrogeologic Report*, March 2004. Additional findings from continuing investigations can be found in two Technical Memoranda: *Phase I Investigations Groundwater Monitoring Well System Enhancements*, October 2007 and *East Main Hill Perched Zones* October 2010.

Chapter 3 discusses the methods used to evaluate and analyze the groundwater data, and Chapter 4 presents the results of these evaluations. Conclusions based on the analyses results are included in Chapter 5.

Groundwater monitoring has been conducted at the CHRLF since 1983. A large quantity of data has been developed for the site as a result of the monitoring program. The groundwater monitoring program and this annual data evaluation are in accordance with the King County Board of Health Solid Waste Regulations (Title 10, Rules and Regulations No. 03-06) and "Criteria for Municipal Solid Waste Landfills" (Chapter173-351 WAC).

2.0 GEOLOGY AND HYDROGEOLOGY

In order to effectively analyze water quality data collected at CHRLF, it is important to have a clear understanding of the regional and site geology and hydrogeology, and to understand groundwater occurrence and flow beneath the Cedar Hills site. Figure 2-1 displays the location of CHRLF in a regional context and Figure 2-2 indicates the environmental monitoring locations for groundwater, surface water and landfill gas migration detection. Figures 2-3 and 2-4 provide cross sectional views of the major hydogeologic features of the landfill site. A detailed discussion of site geology and hydrogeology is beyond the scope of this report, but may be found in the *Cedar Hills Regional Landfill Site wide Hydrogeologic Report*, March 2004 and the *Phase I Investigations Groundwater Monitoring Well System Enhancements Technical Memorandum*, October 2007. Geologic evaluations of the CHRLF site have identified a complex history of sediments deposited by rivers, lakes and glaciers over volcanic and sedimentary bedrock. Sediments beneath the site consist of generally fine grained sands and silts, in some areas part of a prehistoric lake deposit. In the northern portion, the sediments are continuous with coarse sands and gravels, suggesting removal by erosion of the finer sediments and replacement by river channel deposits. These sediments are overlain by a thick blanket of sands and gravels deposited during Vashon era glacial advance. The advance outwash is capped by a complex group of deposits overridden by or deposited from the glacial ice (till, contact deposits and recessional outwash).

Groundwater occurs both as a regional aquifer and in perched zones. The regional aquifer flows through advance outwash and deeper deposits and is separated from the base of waste placement areas by more than 200 feet of unsaturated sands and gravels. Perched groundwater occurs in onsite till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified; therefore, the regional aquifer beneath the landfill is the earliest target hydraulic pathway for groundwater contaminant detection. The regional aquifer potentiometric surface lies at approximately 350 feet MSL at the south property line and at approximately 285 feet MSL at the north east.

The regional aquifer beneath CHRLF is entirely recharged by precipitation. A dominant local recharge area is located immediately south of the landfill within the QCF property, centered north of the Main Gravel Pit Lake. In general, groundwater flow in the regional aquifer is radial from the recharge area. Beneath the landfill, regional flow is to the north in the south and central portions of the landfill site. Flow direction in the northern part of the site turns northeasterly as recharge from the McDonald Creek drainage comes into effect. Flow then converges into a high transmissivity channel and likely discharges to Issaquah Creek. There is no significant seasonal variation in horizontal groundwater flow paths; horizontal gradients are influenced by infiltrating precipitation in the recharge area. Vertical hydraulic gradients in the southern area are demonstrated by head differences in adjacent wells screened at different depths. Flow determinations and a Regional Aquifer Potentiometric Surface Map are prepared quarterly by a licensed Hydrogeologist.

2.1 LOCAL PERCHED WATER BEARING ZONES

A number of local water bearing zones have been identified in the Vashon-aged units around the Cedar Hills site. Table 2-1 lists onsite wells, and gives construction dates and locational information. The perched zones are divided into three groups for discussion and presentation purposes. The North and West perched zones are monitored by five wells and include areas along the west and north buffers and infrastructure north of landfilled areas. The East Main Hill perched zone is monitored by 10 wells and extends along the eastern edge of the landfill adjacent to unlined areas. The South Solid Waste Area (SSWA) perched zone has nine well completions encompassing the non-contiguous South Solid Waste Area and extending into CHRLF's south buffer area, abutting Queen City Farms (QCF). Though water levels are obtained from multiple wells in each zone, lateral or vertical continuity between wells in a zone cannot be assumed.

Recent investigations focused on the SSWA perched zone and the East Main Hill perched zone. The SSWA is monitored by well MW-101 (water levels and water quality), MW-25, MW-41S, MW-41D, MW-45, MW-79, MW-96, MW-97 and MW-105 (water levels only). Findings from this investigation are presented in the Technical Memorandum *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment,* April 2010. The East Main Hill perched zones are monitored by wells MW-30A, MW-47, MW-62 MW-63, and MW-EB6 (water level and water quality); and wells MW-48 and MW-50, MW-102, MW-103 and MW-104 (water levels only), Recent investigation findings for this zone are presented in the *East Main Hill Perched Zones Technical Memorandum*, October 2010.

2.2 Regional Aquifer

The regional aquifer, contained within the pre-Vashon stratigraphic units, has been identified as the shallowest laterally extensive water bearing zone encountered beneath the landfill; and is therefore the earliest target hydraulic pathway for groundwater contaminant detection. A monitoring network is in place consisting of 42 monitoring and three production wells where water level measurements are obtained. Thirty-nine monitoring wells are also sampled and analyzed for water quality. Table 2-1 lists all wells, construction dates and locational information for onsite wells.

The *Cedar Hills Regional Landfill Regional Aquifer Technical Memorandum*, March 2011, is a follow up to the *Groundwater Monitoring Well System Enhancements Phase I* investigation and provides an extensive groundwater flow path analysis of horizontal and vertical gradients, delineates detection zones for regional wells and recommends refinements to the groundwater monitoring network. An addendum to the site-wide hydrogeological report has been prepared that incorporates findings and recommendations of the recent investigations. To support ongoing monitoring and incorporate modifications, an updated sampling and analysis plan, *Environmental Monitoring Sampling and Analysis Plan for Cedar Hills Regional Landfill* will be implemented in 2013.

The piezometric surface contour maps (Appendix I) indicate a north and northeasterly flow direction in the regional aquifer. Interpolation and contouring methodology are the methodology developed for the *Technical Memorandum Phase I Investigations Groundwater Monitoring Well System Enhancements,* October 2007. Quarterly monitoring of groundwater elevations has shown very little seasonal or annual variability in regional groundwater flow and velocity. For 2012, the average horizontal flow velocities for the regional aquifer have been calculated to range from 0.011 ft/day in the south landfill area, to 2.08 ft/day in the central area and 1.57 ft/day in the north area.

3.0 DATA COLLECTION AND EVALUATION

Environmental samples are collected and analyzed in accordance with the *Quality Assurance Project Plan for Environmental Monitoring at King County Solid Waste Facilities* (QAPP) (1999) and the *Environmental Monitoring Sampling and Analysis Plan for Cedar Hills Regional Landfill* (2002) (SAP). These documents contain procedures to ensure that environmental data meet desired objectives for quality, consistency and documentation.

Groundwater quality is evaluated by comparison of analysis results to regulatory standards, geochemical analysis and statistical evaluation. Following is a brief description of each. King County Solid Waste Division monitors groundwater in accordance with Chapter 173-351 WAC.

Data collected include field parameters and laboratory analysis results. These data are evaluated by a variety of graphical and statistical methods. The groundwater evaluation presented herein describes onsite groundwater elevations, flow direction and velocity.

Groundwater chemical data are evaluated to determine if chemical concentrations have changed over time or differ between well locations. Groundwater evaluation serves to determine evidence of impacts to groundwater quality by surface activities.

3.1 DATA REVIEW

Throughout the groundwater monitoring program conducted by KCSWD, numerous Quality Assurance/Quality Control (QA/QC) samples have been collected and analyzed as an ongoing part of meeting data quality objectives. These samples include field and trip blanks, field duplicates and split samples for inter-laboratory comparison. Laboratory data was reviewed as outlined in the QAPP for compliance with Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC).

Field data collection QA/QC is ensured by adherence to standardized procedures of instrument calibration and data acquisition as outlined in the SAP. The laboratory data review is conducted by county staff with the initial responsibility for the correctness and completeness of the data. The reviewer will evaluate the quality of the work based on guidelines established in the QAPP to ensure that:

- Appropriate procedures have been followed.
- Laboratory deliverables are correct and complete.
- Analyses are completed within holding times.
- QC sample and laboratory blank results are within appropriate QC limits.
- Documentation is complete.

Data qualifiers may be assigned to the data based on the QA review. The qualified data will then be made available for data evaluation and interpretation. A compilation of water quality data for groundwater, surface water and leachate are presented in Appendix IV.

3.2 GROUNDWATER ELEVATION AND FLOW

Groundwater potentiometric surface maps and flow velocity calculations are presented in Appendix I. Hydrographs of water levels and precipitation over time are presented in Appendix II. Wells are grouped by detection zones as described in *Regional Landfill Regional Aquifer Technical Memorandum* and by groundwater elevation on the hydrographs.

Flow determinations are calculated quarterly by a Licensed Hydrogeologist and following the model presented in the Hydrogeologic Report and subsequent investigation.

3.3 GROUNDWATER ANALYTICAL DATA

The outcome of the sampling, analysis and data review processes are data that meet the requirements for use in evaluating groundwater quality and can be used as a basis for decision making. Statistical and graphical methods are then applied to answer questions of comparison.

Descriptive statistics are calculated and tabulated to provide a snapshot of data set distributional parameters. These include the number of analyses, number of detections, minimum, maximum, mean, standard deviation and median. Although both means and medians are reported in the summary tables, medians are used in the text because they tend to be a more reliable measure of central tendency in the case of non-normal distributions, particularly when there are outliers, as is the case here.

Using the Shapiro-Wilk test for normality, data sets are tested for approximation to a normal distribution, to determine which statistical procedures, described below in sections 3.5 and 3.6, may be appropriately applied.

3.4 GROUNDWATER QUALITY STANDARDS

Water quality monitoring results are compared to Washington State Groundwater Quality Criteria, Chapter 173-200 WAC. Standards are compared to actual analytical values, not mean or median values. All exceedances are determined by the standards that were in effect at the time of the sampling and are summarized in Tables 4-1a and 4-1b. These tables include primary standard exceedances, those where concentrations are greater than the criteria for analytes having health consequences, and exceedances of secondary criteria, non-mandatory guidelines regarding aesthetic (taste, odor, or color) or cosmetic (tooth or skin discoloration) effects.

3.5 TREND TESTING

Testing for trend is one of our primary means of evaluating water quality data over time. The statistical test used is the Mann-Kendall test for trend. This test is well suited for environmental data (Gibbons 1994) as it makes no distributional assumptions (non-parametric); and allows irregularly spaced (temporally) samples. Values below detection limits are allowed in the calculation, a condition which is frequently encountered in groundwater monitoring. The test yields the probability (p values) that a temporal trend is due to chance. Low p-values indicate low probability of a trend existing solely due to chance, therefore significant evidence of a trend exists. Values of less than 0.05 indicate statistical significance.

This test has been applied to data sets for parameters of value for evaluating water quality or that are indicative of impacts from anthropogenic sources. Naturally occurring trace level constituents with low detection frequencies are not trend tested.

The test is conducted on two data sets from each well; a short term data set consisting of the most recent two years of data, generally eight data points for quarterly monitoring, and a long term data set consisting of up to 50 results prior to the recent data set (data collected in 2010 and older for this report).

To yield meaningful results, trend results must be interpreted carefully in cases where frequency of detection is low or in cases where reporting limits have changed or analytical resolution has changed over the period of record. Trend test are conducted on an annual basis and results are tabulated in the Statistical Summary Tables (Table 4-2a and 4-2b). Statistically significant decreasing trends are denoted by “D” in the table, statistically significant increasing trends by “I”. Absence of a trend and non-significant trends are indicated in the table as “—“.

3.6 PREDICTION LIMITS

The Prediction Limit used in this evaluation is an intrawell statistical test that compares an analytical result to a computed limit value. The limit value is derived from past analytical results from the same well, considered to be representative background data. A value outside of this limiting value is considered evidence that the result is not drawn from the same sample population distribution. Population here refers to the set of potential measurements or values, including not only cases actually observed but those that are potentially observable. The prediction limits generated in this report are based on a 5% false positive rate (type I error) and depend on the background distribution. For each parameter tested, an appropriate background data set is chosen. Limits are recalculated each year with the incorporation of the previous year’s data into the dataset. The updated limits are used to define the range of expected values for future samples. The data set is tested for normality by application of the Shapiro-Wilk Test for Normality. If the data set fails the test for normality, several transformations of the data are tested. When normal or transformed normal data sets are determined, a parametric prediction limit is calculated and future results compared to this value. When all transformations fail the test for normality, a non-parametric method is applied and future results are compared to this limit.

This test is performed on a quarterly basis, Prediction Limit Exceedances of Chapter 173-351 WAC Appendix I constituents are presented in Table 4-3.

3.7 Time-concentration plots

Time plots are generated for parameters with high detection frequencies and relevance to groundwater quality evaluation. The plots contain data from a number of wells grouped by detection zone and flow gradient location. The intent is to give the reader a visual synopsis of relevant and extensive interrelated data, rather than a graphical compilation of analytical results. All non-detections (ND) are displayed on graphs as one-half the limit of detection. All plots are scaled the same, to include the entire range of values measured and to provide a consistent context from plot to plot. Each plot shows analyte concentrations for the period 2001-2012. Since water quality data were typically collected quarterly, the plots are useful for showing temporal changes due to seasonality as well as long-term increasing or decreasing trends and a visual comparison of relative concentration magnitudes for wells in similar spatial and gradient location. Time-Concentration plots for selected parameters are included in Appendix II.

3.8 Trilinear diagrams

Geochemical data is presented on trilinear diagrams. Major cations and anions are plotted on individual triangles as percentages of total milliequivalents per liter (meq/L). These diagrams illustrate differences in major ion chemistry between groundwater samples and can be used to categorize water composition into identifiable groups known as hydrochemical facies. Used here, hydrochemical facies refers to distinct chemical compositions of groundwater solute concentrations contained in an aquifer. In general, a groundwater will have a dominant cation or cation pair and a dominant anion or anion pair. For our purposes, the four dominant possibilities are: calcium/magnesium or sodium/potassium for cations and chloride/sulfate or bicarbonate for anions. These facies reflect distinct compositions of cation and anion concentrations such that the value of the diagram lies in the ability to recognize relationships that exist among individual samples. Trilinear Diagrams are included with ionic balance calculations in Appendix III.

4.0 GROUNDWATER QUALITY EVALUATION

This section contains an overall description of water quality and an examination of contamination issues supported by the data. As perched zones have been identified to be neither laterally or vertically extensive and as such do not provide an opportunity for regional aquifer background characterization nor site-wide detection of waste placement areas; the regional aquifer beneath the landfill is the earliest target hydraulic pathway for groundwater contaminant detection.

Water quality, both upgradient and downgradient, is notable for its variability spatially and over time. This variability is only reasonable considering the history of activities and flow regime in place. Wells comprising the monitoring network serve to provide background characterization and downgradient performance monitoring.

The objective of the monitoring program is to utilize a system consisting of a sufficient number of wells installed at appropriate locations and depths to yield representative ground water samples from those hydrostratigraphic units which have been identified as the earlier target hydraulic pathways. The system provides data capable of providing early warning detection of any groundwater contamination and facilitates decision making that insures protection of human health and the environment.

4.1 REGIONAL AQUIFER GROUNDWATER ELEVATION AND FLOW

The primary recharge area for the regional aquifer is immediately across the south property line. Flow is radial from this center such that the flow across the south property line is oriented S to N. As flow moves northward under the property footprint, it remains predominantly to the north. As the flow approaches the north third of the landfill property, recharge from the McDonald Creek drainage affects flow patterns and flow direction changes to the NE where flow lines converge and the gradient increases. This convergent effect influences regional flow in such a way that concentrates flow into a relatively narrow corridor roughly between wells MW-66 on the NW and MW-67 on the SE. See Figure 4-1.

For the purposes of this review wells are grouped according to gradient and position in the flow regime relative to waste placement and other infrastructure. Upgradient conditions are characterized by south upgradient wells, located along the southern property border; northwest upgradient wells, influenced by the McDonald Creek drainage and northeast upgradient wells, monitoring flow paths appear to originate east if the landfill site and discharge to the convergent flow feeding the Issaquah Creek drainage.

Wells monitoring flows originating outside the landfill footprint and bypassing all landfill facilities are termed crossgradient. There are wells sampled on the east and west of the landfill where these conditions exist.

Flows downgradient of waste cells are monitored by two wells on the west side and six wells located in the convergent flow corridor. Additional flows are monitored by wells placed downgradient of north end facilities (conveyances or pump stations) but not of waste cells.

Finally, two other groups of wells provide data: wells interior to the landfill footprint and wells placed to monitor flow paths vertically beneath facilities or other areas of interest. Table 2-1 lists well groups and Figure 4-2 shows locations.

Response to seasonal rainfall is greatest at the southern wells nearest local recharge and expresses little apparent time delay. Wells along the south property line can exhibit seasonal elevation changes in excess of eight feet and are highest in the spring, immediately following the wettest months of the water year. Seasonal lows generally occur in the fall, at the end of the driest portion of the water year. For example, MW-76, MW-82 and MW-94, wells nearest to the recharge location and screened at the water table have seasonal changes of five to seven feet on average.

Wells placed further from recharge sources experience much less fluctuation with all downgradient water table wells having an average interseasonal range of one foot or less.

Hydrographs of groundwater elevations versus time appear in Appendix II in which seasonal changes in groundwater elevation are plotted along with cumulative annual precipitation. All regional well elevations are plotted along with April – March annual rainfall totals and top of screen elevations. Apparent on this plot are the correlation of seasonal recharge with depth to the water table and proximity to the recharge area. Also apparent are longer, multi-year effects of rainfall total and groundwater elevation. Recent years have experienced higher than average annual rainfall and water levels in regional wells have reached the highest static water levels since the late 1990s. Wells completed in the regional aquifer are screened in pre-Vashon deposits consisting of lacusterine or fluvial sands and silts, alluvial gravels, fluvial gravels and fluvial sands and silts.

4.2 REGIONAL AQUIFER WATER QUALITY

Groundwater in the regional aquifer manifests a high degree of spatial variation and temporal trends. This variability is expected given recharge area site conditions as described. Also contributing to data variability are long term cyclical occurrences, data collection period, time intervals in data sets and analytical variability and sensitivity. Together, these conditions make the establishment of a single benchmark "background water quality" an unusable concept.

Groundwater quality, especially in wells nearest the south recharge zone, is profoundly affected by conditions and activities that have occurred over the past fifty years on the adjoining 320-acre QCF property. In general chronological order these activities included: a pig farming operation that brought MSW in for use as feed; a business that disposed of hazardous waste in excavated pits; a general aviation airport; a solvent reprocessing and recovery operation; a gravel mine with excavation extending down to a level near the water table of the regional aquifer (Gravel Pit

Lake); and an MSW composting facility. The QCF property is listed on the National Priorities List for contaminated sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) and has undergone site remediation efforts that included extensive excavation, stabilization and barrier wall construction. Groundwater quality in south upgradient CHRLF wells is impacted by chlorinated volatile organic compounds (CVOCs) from the QCF site. Presence of these contaminants and their migration is well documented in *Report Evaluation of Remedial Action 10-Year Review Queen City Farms King County, Washington*, 2008 and the *Expanded Hydrogeology Assessment Queen City Farms King County, Washington*, 2010 .

Constituents associated with QCF releases are tetrachloroethene (PCE), trichloroethene (TCE) *cis* 1,2-dichloroethene (1,2-DCE) and vinyl chloride (VC).

As flow continues into areas beneath the landfill footprint changes are discernible as groundwater encounters and equilibrates to different oxidation-reduction conditions, soil gas/groundwater interface conditions and solvent/solute interactions. Attenuation processes also act to continue to degrade and disperse CVOCs from the QCF releases.

LFG Determined Conditions

Important consideration in wells screened at the water table located in flow paths under the footprint and immediately downgradient of waste cells (wells designated as interior, vertical to facilities, northwest downgradient and downgradient) is the influence of landfill gas (LFG) in the unsaturated strata. The presence of LFG significantly raises the partial pressure of carbon dioxide (CO_2) in the unsaturated zone and alters conditions that lead to measurable differences in water quality. Among these are redox sensitive constituents (iron, manganese, arsenic and nitrogen species), carbonate system equilibria (alkalinity and buffering capacity), and dissolution/precipitation processes in which most metal cations participate.

Groundwater under the influence of LFG is best characterized by changes in alkalinity as CO_2 dissolves creating carbonic acid (H_2CO_3), which then brings mineral cations into solution and stabilizes as bicarbonate ion (HCO_3^-). Calcium and magnesium are the primary cations solubilized. Analytically, this process increases specific conductance, total dissolved solids (TDS), total alkalinity metal cations (calcium, magnesium, barium) and associated anions (sulfate).

Viewing the series of time/concentration plots for alkalinity demonstrates this process. Upgradient wells south, northwest and northeast all have alkalinity values generally less than 100 mg/L $CaCO_3$. As flow reaches interior, vertical and downgradient wells values between 100 and 200 mg/L are more common, along with similar increases in calcium, magnesium and barium conductance and TDS.

Following flow further through the site, conditions change as the presence of LFG beyond the landfill footprint is diminished and therefore the partial pressure of CO_2 decreases, the kinetics of the system change and conditions revert to alkalinities below 100 mg/L and concentrations of other similarly mobilized analytes similar to upgradient conditions.

Other Parameters

Time/concentration plots are included for additional regularly detected water quality indicator parameters. These include chloride, nitrate, sulfate, iron, manganese, potassium, sodium, arsenic, barium. Infrequently detected in regional aquifer wells is dichlorodifluoromethane, which is believed to have been inadvertently introduced into MW-24 by a pressurized water level measuring device in the 1990s and which is a minor constituent of landfill gas.

Of these parameters iron, manganese, arsenic, sulfate and nitrate are sensitive to redox conditions and may be mobilized into or depleted from groundwater flow depending on local redox conditions. Native soils can serve as a source material for iron manganese, arsenic and sulfate.

Chloride, potassium and sodium are conservative indicators that do not readily participate in redox, sorption or biological processes and therefore are indicative of an external input to the system.

As with the changes along the flow paths described tor alkalinity and associated parameters, a similar analysis for chloride can be made. Most regional wells in all flow regimes have chloride concentrations generally below 8 mg/L. Exceptions to these levels are notably higher concentrations in the flow paths aligned along MW-66, MW74, MW-75 and MW-91 in the north landfill area and a recent sudden increase in south upgradient wells MW-83 and MW-94. Similar patterns are followed by sodium and potassium in these wells.

The data indicate these observations are consistent with a chloride input from onsite, overlying infrastructure in the north end for the downgradient wells; and by recent land use alterations and site activities offsite on the south end for wells MW-83 and MW-94.

Flows further downgradient onsite have concentrations again below 8 mg/L, reflecting regional aquifer flow mixing and attenuation processes.

4.2.1 Water Quality Exceedances

Water quality exceedances are tabulated in Table 4-1a. Data are compared to Washington State Ground Water Criteria (GWC) (WAC 173-200-040). The secondary standards provide a measure of the aesthetic condition (taste, odor and color) and do not present a risk to human health.

Analytes exceeding primary standards in the regional aquifer are arsenic and the chlorinated volatile organic compounds (CVOCs) trichloroethene (TCE) and vinyl chloride (VC).

Arsenic occurs naturally in native soils and can be mobilized in groundwater by depressed redox and affected by pH conditions and ions available to form complexes or adsorption sites.

Arsenic was detected in eight wells in 2012. These detections are consistent with previous results. All detections exceeded the state GWC of 0.00005 mg/L. Spatially, arsenic detections occur throughout the flow regime, upgradient (MW-99), crossgradient (MW-93), vertically beneath the southeast corner of waste placement (MW-64), downgradient (MW-69, MW-80 and

MW-91) and in wells downgradient to north facilities outside of waste cells (MW-88 and MW-89). None of the arsenic concentrations in regional aquifer wells were higher than the Federal Drinking water maximum contaminant level (MCL) of 0.010 mg/L.

TCE exceeded criteria in three wells (MW-76, MW-82 and MW-94), vinyl chloride in one well (MW-65). Trichloroethene is also consistently detected in wells MW-78 and MW-83 at concentrations below the criteria. Federal drinking water MCL was exceeded in wells MW-76 and MW-82. *Cis*-1,2-dichloroethene (*cis*-1-2DCE) is detected regularly in wells MW-24, MW-56, MW-59 and MW-76, all concentrations well below the GWC. Tetrachloroethene (PCE) is regularly detected in MW-76 at levels below the GWC.

All CVOCs detected in 2012 are in south upgradient wells and known to be compounds disposed of at QCF or degradation products of those compounds.

Secondary standards exceeded include pH, iron and manganese. The lower pH standard of 6.5 was exceeded in MW-76 and MW-78 in 2012. Natural groundwaters in the region tend to be slightly acidic, and can be influenced by surface activities and proximity to recharge by rainfall as rainfall in equilibrium with the atmosphere has a pH of ~5.5. .

Iron and manganese, like arsenic, are naturally occurring and mobilization is controlled by similar processes: redox, pH and sorption. The occurrence and concentrations of iron and manganese vary greatly over short distances. Maximum iron and manganese concentrations between individual upgradient wells vary over three orders of magnitude inferring changing redox conditions vertically and horizontally in the regional aquifer. Iron or manganese above the secondary criteria value occurs in all zones of the regional aquifer.

4.2.2 Trends

Trend test results are tabulated in the Statistical Summary of Groundwater Quality Table 4-2a.

By regulation, a finding of statistical significance is determined for analytes listed in Appendix I of Chapter 173-351 WAC. The trend test is conducted for two time periods: short term including the past two years of monitoring data and long term covering the 50 previous data points. The long term test covers data generated from mid-1998 on, so wells with a longer period of monitoring have truncated data sets.

Appendix I parameters found to have significant trends are as follows:

Appendix I Parameter	**Time**	**Long Term Increase**	**Long Term Decrease**	**Short Term Increase**	**Short Term Decrease**
		Upgradient and Crossgradient			
Nitrate as N		MW-73, MW-84	MW-60, MW-83, MW-99, MW-93	MW-73	MW-93
Arsenic, dissolved			MW-21, MW-81, MW-99, MW-93		MW-99
Barium, dissolved		MW-56, MW-57, MW-59, MW-60, MW-65, MW-83, MW-94, MW-21, MW-73, MW-81, MW-99, MW-95		MW-65	MW-56
Dichlorodifluoromethane			MW-24, MW-21		
cis 1,2-Dichloroethene		MW-59	MW-76		
Tetrachloroethene			MW-76		
Trichloroethene		MW-24	MW-76, MW-82, MW-83, MW74		
Vinyl Chloride, ug/L			MW-65		
		Interior, Vertical and Downgradient			
Nitrate as N		MW-77, MW-64, MW-66, MW-86, MW-88, MW-91	MW-70, MW-67, MW-74	MW-66, MW-74	MW-67
Arsenic, dissolved		MW-88	MW-68, MW-75, MW-89,MW-91		MW-88
Barium, dissolved		MW-67, MW-68, MW-69, MW-74, MW80	MW-70, MW-77, MW-100, MW-72, MW-75, MW-86, MW-88, MW-89, MW-91	MW-67	MW-43
Dichlorodifluoromethane					MW-43
cis 1,2-Dichloroethene					
Tetrachloroethene					
Trichloroethene		MW-78			
Vinyl Chloride					

Decreasing trends of CVOCs are present in most south upgradient wells where QCF impacts have been recognized. Increasing trends of TCE are present in MW-24 and MW-78 and *cis*-1,2 DCE in well MW-59 where further migration and plume spread of parent compounds and degradation products are evident.

Data sets from regional wells are tested for trends using Appendix II water quality indicators such as specific conductance, total dissolved solids (TDS), and dissolved cationic (i.e. calcium, magnesium, potassium, sodium) and anionic species (i.e. bicarbonate, chloride and sulfate) that have sufficient detections to give meaningful results.

Appendix II parameter trend test results indicate variable water quality over time in all wells regardless of placement in the flow net (see Figure 4.1 and Table 4-2a). The character of these flows are representative of groundwater as it flows to Cedar Hills and provides a reference to determine changes that may take place along any of many flow paths between an upgradient well and further downgradient wells.

Interpretation of trends in Appendix II parameters.

Section 4.2 discussed measurable differences attributable to conditions existing on the landfill site. Evidence of LFG/groundwater interaction is apparent in trend analysis of these parameters. There is a strong indication of LFG influence on wells MW-67, MW-68, MW-69 and MW-74 and MW-80 by trends in associated parameters alkalinity, conductance, TDS, calcium and magnesium. Barium frequently tracks with calcium and magnesium do to chemical similarities (Group IIA in the Periodic Table of the Elements). These wells are in flow paths vertical to key facilities, west side downgradient, and downgradient. Indication of LFG influence is also supported by data presented in the Statistical Summary for these wells and analytes and by the time/concentration plots, graphically presenting relative concentrations over time. Additionally, as a part of King County's response to landfill gas migration, discussed in section 8.2 of the annual report, an estimated 850 tons of CO_2 has been extracted from the unsaturated zone above the regional aquifer water table along the west side of the landfill where interaction with groundwater is likely to occur. These extraction points lie very near the flow paths and capture zones for west side downgradient wells MW-69 and MW-72.

An analogous evaluation of trends, flow and time plots can be made for chloride distribution. Long term increasing trend are observed in wells in each group, indicating widespread variability and changing conditions in recharge zones. In the south upgradient zone, trends and time/concentration plots for wells MW-83 and MW-94 stand out. These trend results support the conclusions presented in Section 4.2.

Downgradient wells MW-74, MW-75 and MW-87 display long term chloride trends that support the conclusion of an onsite contribution.

4.2.3 Prediction Limits

While trend testing detects a significant change in relative concentration over time by defining a direction and probability, prediction limit results provide a way of determining if future measurements are inconsistent with an established background. It sets a criterion, a limit value, such that any measurement in a future sample that exceeds that value will be considered to have been drawn from a different population. In order for a prediction limit test to be useful to test for different sample populations between wells, it is assumed that a benchmark background data set can be determined. As discussed with trend testing, a suitable background data set is unavailable. Data drawn from a variable population to construct an interwell prediction limit can lead to erroneous conclusions, indicating contamination by the landfill where there is none, or worse, failing to indicate contamination if it were present. By using an intrawell prediction limit, testing future results from a well against its own background, we can avoid the uncertainty and erroneous conclusions brought in by spatial variation, and we can also determine the existence of a change in water quality at any given monitoring well for the time interval.

The prediction limit concept is useful for evaluating parameters with high detection frequencies to detect water quality changes in discrete time intervals. A test can be done on a sample or sequence of samples (four samples collected in a year) to determine divergence from the underlying population.

By regulation, a finding of statistical significance is determined for analytes listed in Appendix I of Chapter 173-351 WAC. Table 4-3 lists intrawell prediction limit exceedances in these analytes. Parameter, well, sample date, analytical result and limit values for 2012 are included.

Prediction limit exceedances in regional wells include *cis*-1,2-dichloroethene in MW-59, following a long term increasing trend likely representing plume spread from QCF. Barium exceeded the intra-well limit in MW-83, but the concentrations are similar to other south upgradient wells. Nitrate in MW-66 exceeded the limit, also after a long term increasing trend and is less than half the concentration present in MW-73 which is upgradient to MW-66 and along a similar flow path.

The existence of upgradient prediction limit exceedances confirms that there is dynamic, unstable water quality in the regional aquifer flowing to the landfill. The prediction limit statistical test assumes a static, unchanging background dataset to compute expected future values. When this assumption does not hold, as is the case here, it increases the likelihood that exceedances of the computed limit will be found, even when these exceedances are not related to activities attributable to Cedar Hills.

In the case where upgradient water quality is unstable, prediction limits become useful as a tool to determine changing upgradient conditions with quantifiable certainty.

4.3 PERCHED GROUNDWATER

Perched groundwater occurs in onsite glacial till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified. For purposes of presentation and discussion, perched zones are divided into three groups; North and West Perched Zones; East Perched Zone (EPZ); and South Solid Waste Area Perched Zone (SSWA Perched Zone).

Impacts to the EPZ and SSWA by historical site activities have been recognized over the years. Several investigations have been undertaken to clarify interactions between engineered facilities, surface water and perched groundwater, and to further define perched zone extent.

Available data indicate that all onsite perched zones are separated from the regional aquifer by unsaturated deposits ranging from 100 to 300 feet. No laterally or vertically extensive perched zones have been identified leaving the regional aquifer beneath the landfill as the earliest target hydraulic pathway for groundwater contaminant detection. For this reason the regional aquifer, rather than any perched groundwater, is the target hydraulic pathway for detection monitoring.

Sampling and analysis of groundwater in the perched zones allows changes in water quality from site activities to be assessed.

Table 2-1 lists perched wells, construction dates and locational information.

4.3.1 Groundwater Elevation and Flow

Depth to water and seasonal precipitation response plot is located in Appendix II. Flow direction and velocity are not determined due to the discontinuous nature of perched zones. current understanding of groundwater occurrence and flow are presented in the *East Main Hill Perched Zones Technical Memorandum*, published in 2010 for the east perched zones and in *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment*, April 2010, for the SSWA zones.

4.3.2 Water Quality Exceedances

Perched zones water quality exceedances for 2012 appear in Table 4-1b. Water quality exceedances in perched wells are consistent with previous data. In the North and West zone wells, arsenic occurs in MW-27A at concentrations above the GWC. These concentrations are also above the federal drinking water MCL. Secondary standards are exceeded for pH (wells MW-28 and MW-29), iron (MW-55) and manganese (MW-27A and MW-55).

In the EPZ, primary state GWC standards were exceeded for arsenic (MW-47 and MW-EB6), all below the federal MCL; 1,1-dichloroethane (MW-30A and MW-62); and vinyl chloride in well, MW-47, exceeding state criteria but below the federal MCL. Secondary standards were exceeded for pH in MW-30A, MW-62 and MW-EB6, for TDS in MW-47, for iron in MW-47and MW-EB6; and for manganese in MW-47 and MW-EB6.

In the SSWA perched zone, MW-101 exceeded the primary GWC, for arsenic and the vinyl chloride though neither exceeded the federal drinking water MCL. Iron and manganese exceeded the secondary standard in MW-101.

As previously discussed, arsenic occurs naturally in native soils and can be mobilized in groundwater by depressed redox and affected by pH conditions and ions available to form complexes or adsorption sites. The physical and spatial properties of the perched zones enhance the likelihood of exposure to one or more of these mechanisms. Although arsenic can be found in leachate, the probability of leachate as a source of arsenic in groundwater samples is unlikely considering processes such as dilution and sorption that would reduce the contribution from leachate. It is likely that arsenic detected in site wells is mobilized from native soils by redox or pH changes which can be brought about by landfill associated processes.

The frequency and variety and concentration of VOC exceedances in the EPZ and SSWA wells have declined over time. Primary standards have been exceeded by seven VOCs at some point during the monitoring history of the perched zone wells. Presently only two compounds, 1,1-dichloroethane and vinyl chloride have exceeded standards.

Iron and manganese, like arsenic, are naturally occurring and are mobilized by similar processes, redox, pH and sorption. Iron and manganese exceedances occur in both impacted and unimpacted perched wells.

4.3.3 Trends

Trend test results are tabulated in the Statistical Summary of Perched Groundwater Quality Table 4-2c. North and West perched zone wells display few trends short term. In long term data, MW-27A shows significant decreasing trend in ammonia, manganese, arsenic and barium. MW-28 tests significantly decreasing trend in most parameters and an increase in chloride, though all data in are within the historical range. MW-29 shows long term increases in conductance, chloride and magnesium and, as with MW-28, all data in are within the historical ranges. MW-55 displays long term increasing trends in conductance, alkalinity, TDS, alkalinity, sulfate, iron, manganese, calcium and magnesium. Though concentrations remain similar to or below other north and west perched wells, these trends indicate the possible influence of LFG, as MW-55 is located in the vicinity of LFG migration and control efforts conducted in 2012.

East perched zone wells MW-30A and MW-47 show long term increasing trends in multiple parameters associated with the presence of LFG, conductance, TDS, alkalinity, calcium and magnesium. MW-30A also displays long term increases for chloride, potassium and sodium, though all these remain at concentrations within the historical range.

CVOCs, also in MW-30A and MW-47 show long term decreases with the exception of *cis* 1,2-DCE in MW-47 which shows a long term increase yet remains within the historical range. MW-

62 shows long term decreasing trends for most parameters. Short term trends are generally not statistically significant in any east perched zone wells.

Monitoring well MW-EB6 is seasonally dry and often dewaters during purging and sampling. For these reasons, getting representative samples is difficult and the data are highly variable. Even so, trend testing results in long term decreases in conductance, iron, manganese, calcium, magnesium, potassium, arsenic, barium and toluene. Ammonia tests increasing long term. Short term shows increasing trends for Ammonia and sulfate and decreasing potassium.

The South Solid Waste Area perched zone is monitored for water quality by MW-101. Several other SSWA zone wells have been sampled occasionally during ongoing investigation and have not produced sufficient data for trend testing. MW-101 yields short term declining short term trends for pH, conductance, alkalinity, manganese, calcium, potassium, arsenic, barium and vinyl chloride. Long term, there are declining trends for conductance, nitrate, sodium and barium. There are no increasing trends in MW-101.

Short term trends can be influenced by more recent site activities, especially in perched zone wells with high response to seasonal precipitation. Analytical variation can also contribute statistically to trend detection.

4.3.4 Prediction Limits

Perched zone data were tested for intrawell prediction limit exceedances for Appendix I analytes where adequate data are available. In 2012, no exceedances of intrawell prediction limits were detected in any perched wells.

5.0 SUMMARY AND CONCLUSIONS

5.1 REGIONAL AQUIFER

The regional aquifer is the first continuously saturated zone beneath the landfill and serves as the earliest path for detection monitoring. Groundwater flowing onto the CHRLF site is highly variable both spatially and temporally

Recharge of the regional aquifer beneath CHRLF is predominately by rainfall. Primary recharge areas are the McDonald Creek Drainage to the northwest and Gravel Pit Lake centered on the QCF property to the south of the landfill. QCF has been the site of many activities including solid and hazardous waste disposal, solvent reprocessing and recovery; gravel mining; and a composting operation. The property is on the National Priorities List for hazardous waste sites and has gone through remediation efforts including excavation, stabilization and barrier wall construction. These past activities and current conditions affect and define upgradient groundwater quality for CHRLF. Groundwater flow from the recharge area is radial and is monitored by extensive networks of wells at both QCF and CHRLF.

Groundwater data are evaluated according to gradient and position of the well in the flow regime relative to waste placement and other infrastructure. Upgradient conditions are characterized by south upgradient wells, located along the southern property border; northwest upgradient wells, influenced by the McDonald Creek drainage and northeast upgradient wells, monitoring flow paths appear to originate east if the landfill site and discharge to the convergent flow feeding the Issaquah Creek drainage.

Wells monitoring flows originating outside the landfill footprint and bypassing all landfill facilities are termed crossgradient. There are wells sampled on the east and west of the landfill where these conditions exist.

Flows downgradient of waste cells are monitored by two wells on the west side and six wells located in the convergent flow corridor. Additional flows are monitored by wells placed downgradient of north end facilities (conveyances or pump stations) but not of waste cells.

Two other groups of wells provide data: wells interior to the landfill footprint and wells placed to monitor flow paths vertically beneath facilities or other areas of interest.

Upgradient water quality to CHRLF exhibits wide spatial and temporal variation. Contamination of the regional groundwater by CVOCs on the QCF site is well documented, as is migration across the property line and under CHRLF.

The CVOCs TCE, PCE and *cis*-1,2-dichloroethene are detected regularly in several upgradient wells. TCE was present in five upgradient wells, exceeding primary drinking water standards in two. Vinyl chloride is regularly detected in one upgradient well and is likely related to degradation of the PVC monitoring well construction materials. Overall, primary groundwater criteria were exceeded in some upgradient wells for TCE, vinyl chloride and arsenic. Some wells exceeded secondary standards for iron, manganese and occasionally pH.

As flow moves northward under the property footprint, it remains predominantly to the north.

Water quality changes are discernible as groundwater encounters and equilibrates to different oxidation-reduction conditions, soil gas/groundwater interface conditions and solvent/solute interactions. Flow paths under the footprint and immediately downgradient of waste cells are influenced by (LFG) in the unsaturated strata.

Flow paths aligned along MW-66, MW74, MW-75 and MW-91 in the north landfill area have chloride concentrations elevated relative to other regional wells consistent with an input from onsite, overlying infrastructure in the north end.

As the flow approaches the north third of the landfill property recharge from the McDonald Creek drainage comes into effect and flow direction changes to the NE where flow lines converge and the gradient increases. This convergent effect influences regional flow in such a way that concentrates flow into a relatively narrow corridor

A small crescent of wells in the northeast corner of the CHRLF property monitors regional aquifer flow along preferential flow paths downgradient to MSW placement. Landfill activities have raised chloride concentrations in wells MW-66, MW-74, MW-75 and MW-85. Concentrations decline with further flow in the high transmissivity flow path downgradient and reach near background levels as flow leaves the site.

Downgradient ground water quality has been compared to groundwater criteria exceeded primary standards for arsenic and secondary standards for iron, manganese and pH. The CVOCs TCE, PCE and *cis*-1,2 DCE are undetected in downgradient wells. These data indicate that CHRLF is acting as an attenuation zone for upgradient QCF impacts, allowing a reduction in the concentration of VOCs, iron and manganese.

Groundwater analysis indicates the effects of interaction with carbon dioxide from landfill gas migration. This influence is detectable in regional aquifer wells screened near the water table in predominately the central portion of the landfill site. Effects noted are increased alkalinity calcium and magnesium relative to deeper screened wells. Other redox sensitive can be mobilized as well.

Additional findings related to regional aquifer flow analysis and monitoring well detection zones can be found in the *Cedar Hills Regional Landfill Regional Aquifer Technical Memorandum*, March 2011. An addendum to the site-wide hydrogeological report has been prepared and an updated sampling and analysis *Environmental Monitoring Sampling and Analysis Plan for Cedar Hills Regional Landfill* will be implemented in 2013.

5.2 PERCHED ZONES

Perched groundwater occurs in onsite till, ice-contact deposits and recessional outwash. No laterally or vertically extensive perched zones have been identified at CHRLF. Recharge of perched groundwater is by precipitation with possible hydraulic continuity to surface streams.

It is recognized that perched zones are separated from the regional aquifer, are not laterally or vertically extensive and that the regional aquifer beneath the landfill as the earliest target hydraulic pathway for groundwater contaminant detection.

Impacts from historical landfilling methods have previously been recognized in several perched zone wells. Site improvements and engineered facilities have moderated some impacts to water quality as evidenced by the long term declines for many contaminant concentrations in these wells. The influence of landfill gas on groundwater quality continues in east side perched groundwater.

Recent investigations that pertain to perched zone conditions have been completed. The Technical Memoranda *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment,* April 2010, and the *East Main Hill Perched Zones*, October 2010 evaluate occurrence and conditions in the Main Hill and South Solid Waste Area perched zones.

These memoranda include an evaluation of the gas-to-groundwater pathway for contaminant migration and further define extent and flow paths of groundwater in the East Main Hill perched zone, and in the South Solid Waste Area perched zone, confirmation of the local extent and the fate and transport of vinyl chloride.

Secondly, efforts to date to evaluate the integrity and effectiveness of engineered facilities in closed, unlined landfill areas can be found in the *Cedar Hills Regional Landfill Environmental Management Facility Evaluation And Modifications For Closed Landfill Areas, 2007 Summary Report*, 2008.

Results and conclusions from these investigations will be presented in the hydrogeologic report addendum and the updated sampling and analysis plan.

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TABLES

Well Number	Date Constructed	Aquifer	Zone[1]	Purpose[2]	Ground Surface Elevation	Top of Well Casing Elevation	Total Well Depth	Screened Interval Depth		Screened Interval Elevation		Coordinates Northing	Coordinates Easting
MW-24	6/1/1983	Regional	US	WL/WQ	473.8	475.99	193.0	187	192	286.8	281.8	167767.76	1702441.65
MW-54	9/26/1986	Regional	US	WL	579.3	580.43	360.0	329	351	250.3	228.3	168435.53	1702154.28
MW-56	10/12/1988	Regional	US	WL/WQ	479.2	480.33	170.5	156	166	323.2	313.2	167214.82	1698980.77
MW-57	8/22/1988	Regional	US	WL/WQ	455.7	456.64	145.5	129	144	326.7	311.7	167201.99	1699993.32
MW-58A	9/26/1988	Regional	US	WL/WQ	478.6	479.27	220.5	208.5	218.5	270.1	260.1	167207.16	1699006.59
MW-59	8/16/1988	Regional	US	WL/WQ	455.6	457.13	185.5	170.5	180.5	285.1	275.1	167193.44	1699983.91
MW-60	9/13/1991	Regional	US	WL/WQ	564.8	567.15	266.4	230	239	334.8	325.8	167873.2	1701154.47
MW-65	3/29/1993	Regional	US	WL/WQ	543.2	545.83	236.9	225.5	234.3	317.7	308.9	167146.55	1701602.10
MW-76	10/25/1999	Regional	US	WL/WQ	489.8	491.71	155.9	138.7	148.2	351.1	341.6	167193.13	1700376.23
MW-82	11/2/2000	Regional	US	WL/WQ	472.8	474.85	139.5	123.9	133.4	348.9	339.4	167725.31	1699553.72
MW-83	10/27/2000	Regional	US	WL/WQ	494.5	496.81	160.0	144.3	153.8	350.2	340.7	167212.27	1697939.89
MW-94	7/2/2002	Regional	US	WL/WQ	493.2	495.51	168.0	136	144.7	357.2	348.5	167210.22	1698674.21
MW-21	5/17/1983	Regional	UNW	WL/WQ	418.2	420.66	180.0	155	163	263.2	255.2	173876.38	1697901.86
MW-73	7/3/1999	Regional	UNW	WL/WQ	484.3	485.70	218.0	196.2	205.5	288.1	278.8	174995.59	1698954.95
MW-84	10/20/2000	Regional	UNW	WL/WQ	528.7	530.80	250.5	236.2	245.7	292.5	283.0	173894.54	1698602.89
MW-81	10/3/2002	Regional	UNE	WL/WQ	492.2	493.66	199.0	183	192	309.2	300.2	172113.99	1702568.87
MW-99	8/30/2002	Regional	UNE	WL/WQ	491.8	493.64	287.0	270	279	221.8	212.8	172098.73	1702556.06
MW-93	6/24/2002	Regional	CG	WL/WQ	630.2	632.15	350.0	310.3	320.1	319.9	310.1	169851.24	1702259.35
MW-95	7/22/2002	Regional	CG	WL/WQ	568.6	571.54	311.0	254	262.7	314.6	305.9	169426.92	1697265.32
MW-106	2/19/2009	Regional	CG	WL	473.0	475.47	270.0	193	203	280.0	270.0	173461.69	1702536.99
MW-70	5/11/1993	Regional	I	WL/WQ	527.9	530.57	221.5	205.1	218.8	322.8	309.1	168699.89	1698412.97
MW-77	10/12/1999	Regional	I	WL/WQ	550.5	552.67	251.5	230	239.5	320.5	311.0	168999.71	1700007.63
MW-78	10/8/1999	Regional	I	WL/WQ	535.3	537.35	229.5	213	225.5	322.3	309.8	169027.58	1698881.94
MW-100	8/26/2002	Regional	I	WL/WQ	618.4	620.32	124.7	299.3	309.3	319.1	309.1	169610.46	1700791.72
MW-22	5/25/1983	Regional	V	WL	515.0	517.09	284.0	279	283.8	236.0	231.2	173088.17	1701844.34
MW-64	3/22/1993	Regional	V	WL/WQ	594.3	596.55	276.3	260.3	274.1	334.0	320.2	168772.19	1701980.27
MW-66	4/5/1993	Regional	V	WL/WQ	528.6	531.28	250.7	234.2	248	294.4	280.6	174250.32	1699750.19
MW-67	4/28/1993	Regional	V	WL/WQ	514.1	516.43	232.4	216.3	230.1	297.8	284.0	172610.65	1701776.69
MW-68	4/15/1993	Regional	V	WL/WQ	644.8	647.07	354.6	333.5	352.5	311.3	292.3	170609.35	1701917.32
MW-69	4/23/1993	Regional	DW	WL/WQ	651.0	653.69	368.8	357.4	371	293.6	280.0	172400.20	1698061.86
MW-72	8/7/1998	Regional	DW	WL/WQ	669.8	671.87	389.0	366.2	375.8	303.6	294.0	170987.71	1698229.92
MW-74	11/1/2000	Regional	DG	WL/WQ	529.2	531.26	270.0	239.3	248.8	289.9	280.4	173813.79	1700386.85
MW-75	9/24/1999	Regional	DG	WL/WQ	529.8	532.40	287.0	258.7	268.8	271.1	261.0	173432.42	1701059.70
MW-80	2/27/2001	Regional	DG	WL/WQ	528.5	530.41	270.0	249.3	258.8	279.2	269.7	172964.99	1701309.78
MW-85	12/1/2000	Regional	DG	WL/WQ	529.8	531.76	270.0	247.2	256.7	282.6	273.1	173694.52	1701828.95
MW-87	11/21/2000	Regional	DG	WL/WQ	535.2	537.31	272.5	251.5	260.8	283.7	274.4	173493.76	1700670.27
MW-91	10/26/2001	Regional	DG	WL/WQ	529.7	532.02	331.0	268.9	289	260.8	240.7	173423.94	1701023.09
MW-86	12/12/2000	Regional	DNF	WL/WQ	533.9	536.04	282.0	250.5	259.3	283.4	274.6	174917.90	1701331.25
MW-88	9/13/2001	Regional	DNF	WL/WQ	511.2	513.68	248.5	229.7	239	281.5	272.2	174303.06	1701807.87
MW-89	11/12/2001	Regional	DNF	WL/WQ	510.7	512.82	328.0	281.5	290.8	229.2	219.9	174319.44	1701799.57
MW-90	8/14/2002	Regional	DNF	WL/WQ	500.2	502.22	300.0	265	274	235.2	226.2	174300.67	1702203.13
MW-43	4/30/1985	Regional	DNF	WL/WQ	544.6	547.06	325.0	299	309	245.6	235.6	174327.14	1701274.23
WS-ATC-1	2/7/1972	Regional	--	WL	624.9	625.51	535.0	325	340	299.9	284.9	169823.34	1702268.95
WS-NPW-1	8/221990	Regional	--	WL	644.6	646.33	382.0	365.7	375.7	278.9	268.9	171138.99	1701906.96
WS-NPW-3	6/51990	Regional	--	WL	644.3	645.81	376.0	359.4	367.4	284.9	276.9	170663.28	1701922.88

Well Number	Date Constructed	Aquifer	Zone[1]	Purpose[2]	Ground Surface Elevation	Top of Well Casing Elevation	Total Well Depth	Screened Interval Depth		Screened Interval Elevation		Coordinates Northing	Coordinates Easting
MW-30A	9/6/1989	Perched	EPZ	WL/WQ	567.7	568.43	40.0	25	35	542.7	532.7	172345.48	1701628.59
MW-47	6/31/1985	Perched	EPZ	WL/WQ	633.6	634.60	50.0	23.5	43.5	610.1	590.1	171365.53	1701898.69
MW-48	5/24/1985	Perched	EPZ	WL	593.6	594.49	63.0	37	47	556.6	546.6	168758.73	1701985.17
MW-50	6/3/1985	Perched	EPZ	WL	636.2	637.02	39.5	27.5	37.5	608.7	598.7	170276.14	1701873.92
MW-62	2/1/1990	Perched	EPZ	WL/WQ	555.3	556.21	65.5	44	54	511.3	501.3	172397.77	1701719.18
MW-63	2/12/1990	Perched	EPZ	WL	513.8	515.88	22.0	12	17	501.8	496.8	172580.25	1701786.72
MW-102	1/27/2009	Perched	EPZ	WL	549.7	552.48	50	35	50	515.2	500.2	172313.75	1701858.76
MW-103	1/28/2009	Perched	EPZ	WL	636.8	639.08	40.00	25	35	611.8	601.8	170473.99	1702210.55
MW-104	1/29/2009	Perched	EPZ	WL	626.9	629.68	35.00	22	32	604.9	594.9	171153.34	1702169.14
MW-EB6	11/28/1990	Perched	EPZ	WL/WQ	587.9	589.61	50.0	20	30	567.9	557.9	171862.72	1702049.75
MW-27A	10/3/1985	Perched	NW	WL/WQ	583.2	584.23	80.0	59	69	524.2	514.2	169817.29	1697470.72
MW-28	6/21/1983	Perched	NW	WL/WQ	526.2	527.75	39.0	27	37	499.2	489.2	174231.84	1699966.20
MW-29	6/23/1983	Perched	NW	WL/WQ	531.7	532.92	60.0	17	27	514.7	504.7	173552.23	1700926.39
MW-55	10/2/1986	Perched	NW	WL/WQ	651.1	652.29	67.0	37.5	47.5	613.6	603.6	172364.53	1698110.11
MW-98	3/9/2001	Perched	NW	WL	501.6	503.73	22.5	10.7	20	490.9	481.6	174810.64	1699245.65
MW-25	6/3/1983	Perched	SSWA	WL	473.2	474.41	43.0	18	38	455.2	435.2	167760.97	1699580.14
MW-41S	7/12/1983	Perched	SSWA	WL	460.7	462.44	51.0	8	18	452.7	442.7	167171.51	1700100.82
MW-41D	7/12/1983	Perched	SSWA	WL	460.7	462.32	51.0	30	50	430.7	410.7	167171.51	1700100.82
MW-45	5/17/1985	Perched	SSWA	WL	487.7	488.40	64.0	31	41	447.6	457.6	167907.28	1699058.03
MW-79	11/5/1999	Perched	SSWA	WL	456.9	459.17	56.0	40.5	50	416.4	406.9	167175.91	1699495.56
MW-96	12/18/2001	Perched	SSWA	WL	545.4	547.74	102.9	88.8	97.5	456.6	447.9	168667.73	1699434.47
MW-97	9/5/2001	Perched	SSWA	WL	562.5	564.54	124.7	101	110	461.5	452.5	168380.87	1700636.96
MW-101	6/2/2006	Perched	SSWA	WL/WQ	472.1	474.72	57.50	44	54	428.1	418.1	167791.40	1699364
MW-105	1/30/2009	Perched	SSWA	WL	518.7	521.23	30.00	18	28	500.7	490.7	167697.49	1698320.49

Notes

[1]Position of the well screen in the regional aquifer flow path analysis relative to waste placement and site utilities. .

Zone Designations
US = Upgradient South Site Wells
UNW = Upgradient Northwest
UNE = Upgradient Northeast
CG = Cross Gradient
DW = Westside Downgradient
V = Vertical Key Facilites
I = Interior
DNF = Downgradient of North End Facilities outside Refuse Cells
DG = Downgradient Groundwater Flow

[2]WL = Water Level WQ = Water Quality

TABLE 4-1a

CEDAR HILLS REGIONAL LANDFILL

2012 SUMMARY OF GROUNDWATER QUALITY CRITERIA EXCEEDANCES REGIONAL AQUIFER

			Arsenic	Trichloro-ethene	Vinyl Chloride	pH (Field)	Iron	Manganese
						Secondary Criteria		
Well ID	Sample Date	Sample ID	0.0005 mg/L	3 ug/L	0.02 ug/L	< 6.5, > 8.5	0.3 mg/L	0.05 mg/L
			Upgradient Wells					
MW-24	03/01/12	W24-120301-					3.17	0.119
MW-24	04/03/12	W24-120403-					2.94	0.106
MW-24	07/18/12	W24-120718-					3.3	0.105 D
MW-24	10/10/12	W24-121010-					3.08	0.106
MW-56	01/09/12	W56-120109-						0.087
MW-56	04/10/12	W56-120410-						0.050
MW-56	07/13/12	W56-120713-						0.073
MW-56	10/02/12	W56-121002-						0.082
MW-57	01/06/12	W57-120106-					9.35	0.262
MW-57	04/30/12	W57-120430-					8.25	0.238
MW-57	07/09/12	W57-120709-					10	0.295 D
MW-57	10/08/12	W57-121008-					8.83	0.239
MW-58A	03/15/12	W58A120315-					1.1	0.375
MW-58A	04/19/12	W58A120419-					1.05	0.362
MW-58A	07/10/12	W58A120710-					1.04	0.369 D
MW-58A	10/09/12	W58A121009-					0.969	0.313
MW-59	01/06/12	W59-120106-					4	0.102
MW-59	04/24/12	W59-120424-					3.82	0.092
MW-59	07/03/12	W59-120703-					4.25	0.109 D
MW-59	10/08/12	W59-121008-					3.98	0.096
MW-65	01/12/12	W65-120112-			0.044		4.16 D	0.20
MW-65	04/16/12	W65-120416-			0.037		4.2	0.171
MW-65	07/17/12	W65-120717-			0.040		4.6	0.179 D
MW-65	10/12/12	W65-121012-			0.038		4.7	0.195
MW-76	01/26/12	W76-120126-		8.36				
MW-76	04/16/12	W76-120416-		11.50		6.39		
MW-76	07/17/12	W76-120717-		8.30		6.4		
MW-76	10/26/12	W76-121026-		10.10		6.29		
MW-82	01/23/12	W82-120123-		4.81				
MW-82	04/18/12	W82-120418-		4.14				
MW-82	07/03/12	W82-120703-		4.61				
MW-82	10/02/12	W82-121002-		5.06				
MW-83	07/25/11							
MW-94	01/27/12	W94-120127-		3.07				
MW-21	02/16/12	W21-120216-					1.76	0.072
MW-21	04/05/12	W21-120405-					1.63	0.0660
MW-21	07/31/12	W21-120731-					1.78	0.0713
MW-21	10/02/12	W21-121002-					1.66	0.067
MW-99	01/30/12	W99-120130-	0.0025					0.0783 D
MW-99	04/20/12	W99-120420-	0.0024					0.0673
MW-99	07/20/12	W99-120720-	0.0023					0.0601
MW-99	10/05/12	W99-121005-	0.0021					0.0553

TABLE 4-1a

CEDAR HILLS REGIONAL LANDFILL

2012 SUMMARY OF GROUNDWATER QUALITY CRITERIA EXCEEDANCES REGIONAL AQUIFER

Crossgradient and Interior Wells									
MW-93	02/01/12	W93-120201-	0.0014						0.281
MW-93	04/24/12	W93-120424-	0.0013						0.213
MW-93	07/19/12	W93-120719-	0.0015						0.252 D
MW-93	10/10/12	W93-121010-	0.0013						0.238
MW-95	03/01/12	W95-120301-							0.138
MW-95	04/30/12	W95-120430-							0.119
MW-95	07/27/12	W95-120727-							0.130
MW-95	10/25/12	W95-121025-							0.129
MW-78	08/30/12	W78-120830-					6.35		
MW-78	10/26/12	W78-121026-					6.47		
MW-100	01/25/12	W100120125-						1.4	0.219 D
MW-100	04/17/12	W100120417-						1.41	0.219
MW-100	07/27/12	W100120727-						1.53	0.222
MW-100	10/04/12	W100121004-						1.37	0.225
Wells Vertical to Key Facilities									
MW-64	03/30/12	W64-120330-	0.0024					0.76	0.847
MW-64	04/27/12	W64-120427-	0.00146					0.347	0.3370
MW-64	07/19/12	W64-120719-	0.00156					0.589	0.4260
MW-67	1/12/2012	W67-120112-							0.058
MW-67	4/6/2012	W67-120406-							0.060
MW-67	7/24/2012	W67-120724-							0.092
MW-67	10/15/12	W67-121015-							0.092
MW-68	1/17/2012	W68-120117-						1.2 D	0.205
MW-68	4/26/2012	W68-120426-						0.99	0.193
MW-68	7/25/2012	W68-120725-						0.99	0.208
MW-68	10/16/12	W68-121016-						1.13	0.227

TABLE 4-1a

CEDAR HILLS REGIONAL LANDFILL

2012 SUMMARY OF GROUNDWATER QUALITY CRITERIA EXCEEDANCES REGIONAL AQUIFER

Downgradient Wells								
MW-69	01/13/12	W69-120113-	0.0023				1.03 D	0.19
MW-69	04/25/12	W69-120425-	0.0019				0.7	0.147
MW-69	10/19/12	W69-121019-	0.0024				1.23	0.206
MW-69								
MW-72	01/13/12	W72-120113-					1.87 D	0.258
MW-72	04/17/12	W72-120417-					1.73	0.266
MW-72	07/26/12	W72-120726-					2.15	0.275
MW-72	10/04/12	W72-121004-					2.03	0.258
MW-74	1/23/2012	W74R120123-					1.2	0.07
MW-75	01/23/12	W75-120123-					1.53	0.12
MW-75	04/20/12	W75-120420-					1.35	0.122
MW-75	07/23/12	W75-120723-					1.64	0.123
MW-75	10/10/12	W75-121010-					1.43	0.111
MW-80	1/25/2012	W80-120125-	0.0044				1.330	0.247 D
MW-80	4/23/2012	W80-120423-	0.0050				1.680	0.273
MW-80	7/16/2012	W80-120716-	0.0042				1.530	0.235 D
MW-80	10/19/12	W80-121019-	0.0042				1.55	0.245 D
MW-86	1/27/2012	W86-120127-					0.455	
MW-86	10/18/12	W86-121018-					0.306	
MW-87	01/23/12	W87-120123-					3.0	0.365 D
MW-87	04/20/12	W87-120420-					3.3	0.37
MW-87	07/20/12	W87-120720-					3.26	0.353
MW-87	10/05/12	W87-121005-					3.21	0.34
MW-88	01/30/12	W88-120130-	0.0011					
MW-88	04/17/12	W88-120417-	0.0011					
MW-88	07/25/12	W88-120725-	0.0011					
MW-89	01/10/12	W89-120110-	0.0013				0.70	0.26
MW-89	04/10/12	W89-120410-	0.0015				0.81	0.241
MW-89	07/13/12	W89-120713-	0.0014				0.853	0.252 D
MW-89	10/12/12	W89-121012-	0.0014				0.825	0.23
MW-90	01/10/12	W90-120110-					1.1	0.265
MW-90	04/09/12	W90-120409-					1.10	0.266
MW-90	07/16/12	W90-120716-					1.14	0.245 D
MW-90	10/22/12	W90-121022-					1.08	0.244 D
MW-91	01/06/12	W91-120106-	0.0016				0.9	0.238
MW-91	04/10/12	W91-120410-	0.0023				2.70	0.274
MW-91	07/16/12	W91-120716-	0.0019				2.51	0.275 D
MW-91	10/31/12	W91-121031-	0.00168 D				2.45 D	0.405 D
MW-43	1/30/2012	W43-120130-					0.94	0.233 D
MW-43	4/6/2012	W43-120406-					0.87	0.21
MW-43	7/3/2012	W43-120703-					0.94	0.231 D
MW-43	10/04/12	W43-121004-					0.97	0.197

TABLE 4-1b

CEDAR HILLS REGIONAL LANDFILL

2012SUMMARY OF GROUNDWATER QUALITY STANDARD EXCEEDANCES PERCHED ZONES

			Arsenic	1,1-Dichloro-ethane	Vinyl Chloride	pH (Field)	TDS	Iron	Manganese
						Secondary Standards			
Well ID	Sample Date	Sample ID	0.0005	1 ug/L	0.02 ug/L	< 6.5, > 8.5	500	0.3	0.05
North and West Perched Wells									
MW-27A	01/05/12	W27A120105-	0.0161						0.054
MW-27A	04/03/12	W27A120403-	0.0157						0.0522
MW-27A	07/13/12	W27A120713-	0.0156						0.0665 D
MW-27A	10/11/12	W27A121011-	0.016						0.0671
MW-28	01/05/12	W28-120105-				5.6			
MW-28	04/09/12	W28-120409-				5.6			
MW-28	07/16/12	W28-120716-				5.6			
MW-29	01/12/12	W29-120112-				6.4			
MW-29	04/04/12	W29-120404-				6.3			
MW-29	07/16/12	W29-120716-				5.9			
MW-55	01/10/12	W55-120110-						0.3	0.17 D
MW-55	04/06/12	W55-120406-							0.14
MW-55	07/18/12	W55-120718-							0.146 D
MW-55	10/19/12	W55-121019-						0.3	0.158 D
East Perched Zone Wells									
MW-30A	01/05/12	W30A120105-		2.37		6.4			
MW-30A	04/03/12	W30A120403-		2.26		6.4			
MW-30A	07/03/12	W30A120703-		2.60		6.1			
MW-30A	10/12/12	W30A121012-		2.43		6.3			
MW-47	01/05/12	W47-120105-	0.00102		8.55		620	0.5	1.36
MW-47	04/05/12	W47-120405-			6.15		657	0.6	1.4
MW-47	07/17/12	W47-120717-	0.00114		4.54		663	0.3	1.75 D
MW-47	10/08/12	W47-121008-			5.04		702		1.38 D
MW-62	01/06/12	W62-120106-				6.2			
MW-62	04/03/12	W62-120403-		1.35		6.3			
MW-EB6	01/09/12	WB6-120109-	0.00669			5.2		10.6	0.846
MW-EB6	04/06/12	WB6-120406-	0.00106			6.2		2.0	0.783
MW-EB6	07/18/12	WB6-120718-	0.00182			6.0		28.0	1.06 D
South Solid Waste Area Wells									
MW-101	01/31/12	W101120131-	0.00779		0.41			1.3	1.6 D
MW-101	04/09/12	W101120409-	0.00568		0.43				1.32
MW-101	07/26/12	W101120726-	0.00629		0.30				1.23
MW-101	10/26/12	W101121026-	0.00411		0.22				1.15

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-24		MW-56		MW-57		MW-58A		MW-59		MW-60 Upgradient South		MW-65		MW-76		MW-82		MW-83		MW-94	
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field) Standard Units																						
No. of Analyses	73	8	72	8	71	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	34	8
No. of Detections	73	8	72	8	71	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	33	8
Maximum	9.06	7.2	8.4	7.1	7.6	6.8	9.0	7.6	8.7	7.1	7.5	7.1	8.2	7.2	7.0	6.7	7.7	6.9	7.6	7.2	7.5	7.1
Minimum	5.94	6.8	5.9	6.7	6.3	6.6	6.0	7.3	5.9	6.8	6.2	6.8	6.4	6.7	6.2	6.3	6.5	6.7	6.7	6.7	0.0	6.8
Mean	7.068	7.1	7.1	6.9	6.9	6.7	7.5	7.4	7.1	7.0	7.1	7.0	7.1	6.9	6.5	6.4	6.9	6.9	7.1	6.9	6.8	6.9
Standard Deviation	0.367	0.13	0.34	0.13	0.26	0.09	0.35	0.10	0.35	0.12	0.21	0.12	0.35	0.19	0.18	0.15	0.20	0.06	0.19	0.15	1.23	0.10
Median	7.01	7.1	7.1	6.9	6.9	6.7	7.5	7.4	7.1	6.9	7.1	7.0	7.1	6.9	6.6	6.4	6.9	6.9	7.1	6.9	7.0	6.9
Specific Conductance, (Field) micromhos/cm																						
No. of Analyses	73	8	71	8	71	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	71	8	71	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
Maximum	303	198	255	165	300	230	265	313	250	185	500	215	175	175	330	190	220	277	190	355	160	397
Minimum	133	103	120	108	180	133	115	115	145	111	130	135	88	97	115	108	150	154	100	187	115	141
Mean	194	174	161	146	231	200	173	193	171	163	237	189	140	144	149	168	182	227	158	278	139	261
Standard Deviation	39	29	34	21	31	32	29	57	16	24	101	30	13	22	32	28	18	41	17	61	10	84
Median	190	183	150	152	230	204	170	190	170	171	198	200	140	148	145	175	180	235	160	280	140	285
Total Dissolved Solids, mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	42	8	35	8
No. of Detections	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	42	8	35	8
Maximum	200.0	119	151	114	1100	169	157	126	250	121	300	143	170	106	140	144	210	181	140	238	150	220
Minimum	74.0	93	56	90	92	136	75	111	27	98	31	117	60	87	60	98	97	124	42	107	77	99
Mean	117.0	108	97	98	159	151	110	120	103	109	150	125	89	99	97	114	127	157	105	177	96	164
Standard Deviation	22.61	8	20	10	115	11	19	6	25	9	60	8	16	7	18	17	20	20	18	40	15	40
Median	118.0	111	97	93	146	148	110	120	100	108	130	123	89	102	95	108	122	162	110	182	94	171
Alkalinity, total (CaCO3), mg/L																						
No. of Analyses	64	8	63	8	63	8	63	8	63	8	63	7	63	8	45	8	42	8	43	8	35	8
No. of Detections	64	8	63	8	63	8	63	8	63	8	63	7	63	8	45	8	42	8	43	8	35	8
Maximum	110	74	86	58	110	88	96	112	110	65	260	96	76	55	66	60	90	122	80	145	64	150
Minimum	3	63	47	44	72	74	55	73	54	61	60	83	42	51	38	47	38	77	50	68	44	58
Mean	74	66	59	50	90	84	71	80	67	62	102	88	52	54	47	54	77	99	61	118	51	103
Standard Deviation	17	4	9	5	10	5	8	13	7	1	43	5	4	1	6	4	8	14	7	26	3	28
Median	75	65	56	49	91	86	72	76	66	62	90	86	52	54	46	55	78	99	60	117	50	108
Ammonia as N, mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	57	8	25	0	55	8	68	8	25	1	9	0	26	2	6	0	6	0	7	0	8	1
Maximum	0.4	0.0	0.2	ND	0.2	0.0	0.3	0.1	0.0	0.0	0.0	ND	0.1	0.0	0.2	ND	0.1	ND	0.3	ND	0.9	0.1
Minimum	ND	0.0	ND	ND	ND	0.0	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	0.0	0.0	0.0	ID	0.0	0.0	0.1	0.1	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	ID
Standard Deviation	0.06	0.00	0.02	ID	0.02	0.01	0.04	0.00	0.01	ID	0.03	ID	0.01	ID	0.03	ID	0.03	ID	0.05	ID	0.15	ID
Median	0.0	0.0	0.0	ID	0.0	0.0	0.1	0.1	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	ID
Chloride, mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	71	8	72	8	72	8	72	7	69	8	45	8	42	8	43	8	35	8
Maximum	7.8	4.3	5.0	4.3	8.5	5.5	9.3	4.5	6.3	4.4	5.0	2.9	7.0	5.0	8.0	11.7	10.0	9.5	24.8	30.2	4.9	25.8
Minimum	3.0	3.4	2.0	3.6	ND	4.5	3.0	3.4	2.9	3.9	2.6	1.5	ND	1.8	2.0	4.2	4.0	4.0	3.0	5.1	3.0	4.0
Mean	4.3	3.8	3.4	4.0	5.1	5.0	4.6	3.7	3.9	4.1	3.4	2.5	4.3	3.9	4.6	7.5	6.0	6.4	4.8	17.0	3.6	17.4
Standard Deviation	1.0	0.4	0.7	0.2	1.4	0.4	1.4	0.4	1.1	0.2	0.6	0.5	1.0	0.9	1.1	3.3	1.5	1.7	3.2	7.4	0.6	6.4
Median	4.0	3.8	3.1	4.0	5.0	5.1	4.0	3.6	3.7	4.1	3.2	2.6	4.0	4.0	4.4	6.0	6.0	6.4	4.1	17.6	3.6	18.6

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-21		MW-73		MW-84		MW-81		MW-99		MW-93		MW-95	
	Upgradient Northwest						Upgradient Northeast				Cross Gradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field) Standard Units														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	9.4	7.9	7.5	7.2	7.3	7.0	7.7	7.2	8.1	7.9	7.9	7.3	7.6	7.5
Minimum	5.9	7.1	0.3	6.6	6.5	6.8	6.9	6.9	7.4	7.5	6.8	7.1	7.1	7.2
Mean	7.4	7.5	6.8	6.9	7.0	6.9	7.3	7.1	7.7	7.8	7.3	7.2	7.4	7.4
Standard Deviation	0.46	0.26	1.02	0.20	0.20	0.09	0.18	0.09	0.18	0.13	0.17	0.06	0.13	0.10
Median	7.4	7.5	7.0	6.8	7.0	6.9	7.3	7.1	7.7	7.8	7.3	7.2	7.4	7.4
Specific Conductance, (Field) microm														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	162	135	170	160	155	160	135	141	150	135	300	391	225	222
Minimum	65	69	115	99	100	86	95	77	110	78	120	257	160	124
Mean	109	113	148	142	137	139	117	123	119	124	242	358	195	194
Standard Deviation	12	20	13	20	11	23	9	23	9	19	35	43	16	34
Median	110	115	145	148	140	145	120	133	115	131	233	365	195	209
Total Dissolved Solids, mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	43	8	44	8	33	8	36	8	37	8
Maximum	140	84	1100	108	130	105	140	92	210	93	650	276	150	138
Minimum	25	67	61	91	ND	77	56	78	36	80	130	232	110	107
Mean	68	76	122	101	85	93	87	86	87	85	180	250	129	128
Standard Deviation	16	6	150	5	19	9	15	5	32	4	86	15	12	9
Median	68	76	100	102	88	93	85	88	81	84	160	245	130	129
Alkalinity, total (CaCO3), mg/L														
No. of Analyses	61	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	61	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	62	55	78	57	120	61	66	52	100	53	110	114	100	87
Minimum	38	43	42	48	46	53	41	47	46	49	64	98	78	78
Mean	46	52	60	54	60	58	48	50	54	52	94	108	88	85
Standard Deviation	5	4	7	3	10	2	5	1	9	1	8	6	6	3
Median	46	53	60	54	59	58	47	50	52	52	95	111	87	85
Ammonia as N, mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	25	2	6	0	4	0	6	0	21	8	26	8	16	8
Maximum	0.2	0.0	0.2	ND	0.1	ND	0.1	ND	0.1	0.1	0.2	0.1	0.2	0.0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0	ND	0.1	ND	0.0
Mean	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	0.1	0.0	0.1	0.0	0.0
Standard Deviation	0.03	ID	0.03	ID	0.02	ID	0.02	ID	0.03	0.01	0.03	0.01	0.04	0.00
Median	0.0	ID	0.0	ID	0.0	ID	0.0	ID	0.0	0.1	0.0	0.1	0.0	0.0
Chloride, mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	69	8	44	8	43	8	44	8	33	8	36	8	37	8
Maximum	4.0	5.0	3.9	3.6	3.9	5.7	5.0	3.5	3.6	3.4	8.0	3.0	5.8	6.1
Minimum	ND	2.7	ND	3.0	ND	3.4	2.0	2.7	2.0	2.9	1.6	2.7	3.8	4.8
Mean	2.6	3.1	2.9	3.3	3.2	3.9	2.3	2.9	2.7	3.2	3.1	2.8	4.5	5.4
Standard Deviation	0.5	0.8	0.6	0.2	0.5	0.8	0.5	0.3	0.5	0.2	0.9	0.1	0.6	0.4
Median	2.8	2.8	3.0	3.3	3.0	3.7	2.1	2.8	2.9	3.2	3.0	2.8	4.3	5.4

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-24		MW-56		MW-57		MW-58A		MW-59		MW-60 Upgradient South		MW-65		MW-76		MW-82		MW-83		MW-94	
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Nitrate as N, mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	19	0	54	7	20	0	8	0	14	0	66	7	10	0	45	8	42	8	43	7	35	7
Maximum	1.0	ND	1.6	1.6	1.0	ND	1.1	ND	1.0	ND	4.9	1.4	0.1	ND	2.1	1.2	1.5	1.0	1.8	0.7	1.5	1.3
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	0.9	0.4	0.6	0.6	0.1	ND	0.8	ND
Mean	0.0	ID	0.2	0.8	0.0	ID	0.0	ID	0.0	ID	1.8	1.3	0.0	ID	1.4	0.8	1.0	0.8	0.6	0.2	1.1	0.6
Standard Deviation	0.15	ID	0.27	0.63	0.12	ID	0.13	ID	0.12	ID	0.88	0.10	0.02	ID	0.35	0.33	0.19	0.12	0.29	0.26	0.18	0.52
Median	0.0	ID	0.2	0.8	0.0	ID	0.0	ID	0.0	ID	1.8	1.3	0.0	ID	1.4	0.9	0.9	0.8	0.6	0.1	1.0	0.5
Sulfate, mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	72	8	72	8	72	8	72	7	69	8	44	8	42	8	43	8	35	8
Maximum	39	17	24	21	22	19	25	17	23	19	13	8	20	17	24	25	18	18	63	15	20	10
Minimum	9	15	12	13	2	17	9	15	14	17	6	7	ND	12	ND	11	12	13	12	6	9	2
Mean	16	16	18	17	19	18	15	16	17	18	7	8	15	15	17	19	14	15	17	10	14	6
Standard Deviation	4	0	3	3	2	0	4	1	2	1	2	0	3	2	4	5	2	2	8	3	3	2
Median	17	16	17	16	18	18	16	16	17	17	7	8	15	16	18	21	14	15	16	10	14	6
Iron, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	5	72	8	72	8	72	8	67	4	70	8	37	0	34	0	35	0	29	1
Maximum	8.8	3.8	4.7	0.0	11.0	10.0	8.5	1.2	7.5	4.6	0.4	0.0	8.4	4.7	8.8	ND	0.2	ND	0.1	ND	0.3	0.0
Minimum	1.7	2.9	0.0	ND	6.6	8.3	0.8	1.0	3.1	3.8	ND	ND	0.4	4.0	ND	ND	ND	ND	ND	ND	ND	ND
Mean	4.7	3.3	0.6	0.0	8.5	9.3	1.2	1.1	4.4	4.2	0.1	0.0	3.5	4.4	0.2	ID	0.1	ID	0.0	ID	0.0	ID
Standard Deviation	1.36	0.24	0.63	0.01	0.92	0.55	0.89	0.08	0.52	0.27	0.07	0.01	1.06	0.25	1.31	ID	0.05	ID	0.03	ID	0.05	ID
Median	4.3	3.3	0.5	0.0	8.6	9.5	1.1	1.0	4.3	4.1	0.1	0.0	3.8	4.3	0.0	ID	0.1	ID	0.0	ID	0.0	ID
Manganese, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	72	8	71	8	72	8	41	3	70	8	7	0	5	0	21	6	8	2
Maximum	0.684	0.146	0.330	0.087	0.471	0.295	0.490	0.383	0.350	0.109	0.028	0.002	0.382	0.200	0.067	ND	0.002	ND	0.017	0.069	0.035	0.012
Minimum	0.1	0.1	0.1	0.1	0.2	0.2	ND	0.3	0.1	0.1	ND	ND	0.1	0.2	ND	ND	ND	ND	ND	ND	ND	ND
Mean	0.3	0.1	0.2	0.1	0.3	0.3	0.3	0.4	0.1	0.1	0.0	0.0	0.2	0.2	0.0	ID	0.0	ID	0.0	0.0	0.0	ID
Standard Deviation	0.14	0.01	0.06	0.01	0.06	0.02	0.07	0.02	0.03	0.01	0.01	0.00	0.03	0.01	0.01	ID	0.00	ID	0.00	0.02	0.01	ID
Median	0.2	0.1	0.2	0.1	0.3	0.3	0.3	0.4	0.1	0.1	0.0	0.0	0.2	0.2	0.0	ID	0.0	ID	0.0	0.0	0.0	ID
Calcium, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
Maximum	25	14	28	16	27	19	27	19	23	14	59	22	14	12	17	19	21	24	23	41	16	40
Minimum	11.0	12.3	11	13.9	15	16	11	15.4	12	12	12	16.0	9	11	8.8	12	9.1	16.3	11	16	11	14
Mean	16.7	12.9	16.4	15.0	19.7	16.9	17	17.2	14.3	13.1	26.9	18.2	11.4	12	12.8	15.1	17.0	20.8	16.2	29.6	13.5	25.7
Standard Deviation	3.7	0.5	4.6	0.6	3.0	1.0	3.2	1.4	1.7	0.4	13.7	1.8	1.1	0.4	2.0	2.3	2.5	2.9	2.2	7.3	1.2	7.9
Median	16.0	12.6	14	15	19	16.7	17	16.8	14	13	20.7	18.0	11.2	11.9	13	15.1	17	21.3	16	30.2	13	25.2
Magnesium, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
Maximum	15.0	9.0	11.3	6	14.6	10.0	12.4	9	13.0	9	25	11	7.9	8.0	8	8.7	12.0	14.9	9	18	7	16
Minimum	6.7	8.1	4.6	5.0	7.7	7.8	6.2	7.8	7.1	7.6	6.4	7.4	4.7	6.7	4.0	5.1	5.0	9.5	4.7	8	4.6	6.2
Mean	10.0	8.5	7.2	5.7	10.7	9.3	8.4	8.5	8.4	8.2	12.2	8.7	6.4	7.1	5.6	6.7	9.6	12.3	6.5	12.4	5.7	11.0
Standard Deviation	2.0	0.3	1.6	0.5	1.7	0.7	1.5	0.6	0.9	0.4	5.9	1.1	0.6	0.4	0.9	1.0	1.3	1.9	1.0	3.0	0.6	3.3
Median	9.8	8.6	6.8	5	10.6	9.5	8	8.4	8.3	8.3	9.6	8.4	6	6.9	5.5	6.7	9.9	12.6	6.4	12	6	11.1

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-21		MW-73		MW-84		MW-81		MW-99		MW-93		MW-95	
	Upgradient Northwest						Upgradient Northeast				Cross Gradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Nitrate as N, mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	12	0	45	8	44	8	44	8	28	8	14	4	4	0
Maximum	1.9	ND	2.1	2.0	1.4	0.6	1.8	1.6	0.5	0.0	1.2	0.0	0.1	ND
Minimum	ND	ND	0.4	1.6	0.1	0.3	0.5	1.5	ND	0.0	ND	ND	ND	ND
Mean	0.0	ID	1.1	1.8	0.4	0.5	1.6	1.5	0.1	0.0	0.1	0.0	0.0	ID
Standard Deviation	0.23	ID	0.53	0.14	0.27	0.09	0.24	0.04	0.16	0.01	0.20	0.01	0.01	ID
Median	0.0	ID	1.1	1.8	0.5	0.5	1.6	1.5	0.1	0.0	0.0	0.0	0.0	ID
Sulfate, mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	44	8	44	8	43	8	33	8	36	8	37	8
Maximum	9	5	24	9	18	13	11	9	18	8	78	101	28	18
Minimum	2	5	ND	8	10	11	ND	8	6	7	1	74	14	16
Mean	7	5	13	9	12	12	8	8	8	8	38	83	18	16
Standard Deviation	1	0	4	0	1	1	2	0	3	0	18	9	3	1
Median	7	5	13	9	13	12	8	8	7	8	32	80	16	16
Iron, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	37	0	36	0	35	0	33	8	27	0	30	0
Maximum	3.7	2.2	0.12	ND	0.48	ND	0.14	ND	0.22	0.04	0.25	ND	0.19	ND
Minimum	1.30	1.6	ND	ND	ND	ND	ND	ND	0.0	0.0	ND	ND	ND	ND
Mean	2.2	1.8	0.0	ID	0.0	ID	0.0	ID	0.0	0.0	0.1	ID	0.1	ID
Standard Deviation	0.48	0.19	0.03	ID	0.07	ID	0.02	ID	0.03	0.00	0.05	ID	0.05	ID
Median	2.1	1.8	0.0	ID	0.0	ID	0.0	ID	0.0	0.0	0.1	ID	0.1	ID
Manganese, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	8	0	43	7	8	4	33	8	36	8	37	8
Maximum	0.093	0.081	0.012	ND	0.037	0.006	0.006	0.001	0.150	0.078	0.293	0.369	0.240	0.138
Minimum	0.03	0.07	ND	ND	ND	ND	ND	ND	0.0	0.1	0.1	0.2	0.1	0.1
Mean	0.1	0.1	0.0	ID	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.1	0.1
Standard Deviation	0.02	0.01	0.00	ID	0.01	0.00	0.00	0.00	0.03	0.01	0.03	0.05	0.05	0.01
Median	0.1	0.1	0.0	ID	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.1	0.1
Calcium, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	14	10	19	14	15	11	12	11	10	9	34	37	23	19
Minimum	7	9	12	11.8	8.8	9	8	10	7	8	20.0	29	10.0	17
Mean	8.7	9.5	14.3	12.4	10.7	10.4	10.2	10.6	8.5	8.7	25	34	19.6	18.5
Standard Deviation	1.0	0.4	1.6	0.6	1.0	0.6	1.1	0.3	0.7	0.3	3.3	2.7	2.2	0.5
Median	9	9.4	14	12.3	11	10	10	11	8.5	8.8	24	35	20	18.6
Magnesium, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	8	7	16	6.5	9.7	9.0	7	6	4.5	4	17.3	17.9	12	10.5
Minimum	3.9	5.1	4.6	4.9	4.4	7.3	5	5	3.0	3.9	9.7	15.4	6.8	8.2
Mean	5	5.7	7.1	6.1	8.0	7.9	5	5.6	4	4.0	12.6	17.2	10.1	9.7
Standard Deviation	0.6	0.5	1.6	0.5	0.9	0.5	0.5	0.3	0.4	0.1	2.1	0.8	1.0	0.7
Median	5	5.6	6.9	6.2	7.9	7.8	5	5.6	3.7	4.1	12.0	17.5	10.0	9.8

Table 4-2a
Statistical Summary of Regional Aquifer
Groundwater Data

Well Location	MW-24		MW-56		MW-57		MW-58A		MW-59		MW-60 Upgradient South		MW-65		MW-76		MW-82		MW-83		MW-94	
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Potassium, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	72	8	72	8	72	8	72	7	69	8	45	8	42	8	43	8	35	8
Maximum	1.6	0.978	2.4	1.15	3.4	1.01	1.6	1.16	3.3	1.14	2.3	1.33	1.2	1.01	1.3	1.35	1.7	1.77	2	2.82	1.7	2.53
Minimum	0.7	0.8	0.8	0.8	0.7	0.9	0.6	0.9	0.6	0.9	0.9	1.0	ND	0.9	0.9	1.0	0.7	1.4	1.4	1.7	1.1	1.6
Mean	1.0	0.8	1.3	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.3	1.2	0.9	0.9	1.1	1.2	1.4	1.6	1.7	2.2	1.4	2.0
Standard Deviation	0.2	0.1	0.4	0.1	0.4	0.0	0.2	0.1	0.3	0.1	0.4	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.4	0.1	0.3
Median	0.9	0.8	1.2	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.2	1.2	0.9	0.9	1.1	1.18	1.4	1.6	1.7	2.2	1.4	2.0
Sodium, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
Maximum	7.42	5.59	6.61	4.95	22	7.32	7.8	5.78	7.6	5.67	14	6.47	7.74	5.61	9.2	8.04	6.51	7.19	6.6	8.42	6	8.52
Minimum	5.1	4.78	4	4.29	5.3	5.84	4.3	4.97	4.73	4.91	4.7	5.06	4.5	5.13	6	5.72	4.9	5.54	4.7	5.79	4.3	5.27
Mean	6.0	5.2	5.0	4.7	7.0	6.5	5.5	5.4	5.6	5.3	6.9	5.7	5.2	5.4	7.4	7.1	5.7	6.4	5.4	6.9	4.9	6.5
Standard Deviation	0.7	0.3	0.6	0.2	1.9	0.6	0.7	0.3	0.5	0.3	2.0	0.5	0.4	0.2	0.7	0.7	0.5	0.5	0.5	0.7	0.4	1.1
Median	5.8	5.3	4.9	4.7	6.8	6.7	5.3	5.4	5.6	5.3	6.0	5.7	5.1	5.4	7.3	7.1	5.7	6.6	5.2	6.8	4.8	6.3
Arsenic, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	9	0	3	0	9	0	1	0	2	0	1	0	17	0	0	0	0	0	1	0	0	0
Maximum	0.002	ND	0.002	ND	0.003	ND	0.001	ND	0.001	ND	0.001	ND	0.002	ND	ND	ND	ND	ND	0.001	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	0.001	ID	0.001	ID	0.001	ID	ID	ID	ID	ID	ID	ID	0.001	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	0.000	ID	0.000	ID	0.0004	ID	ID	ID	ID	ID	ID	ID	0.000	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	0.001	ID	0.001	ID	5E-04	ID	ID	ID	ID	ID	ID	ID	5E-04	ID	ID	ID	ID	ID	ID	ID	ID	ID
Barium, dissolved mg/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	72	8	72	8	70	8	70	8	71	8	72	7	70	8	45	8	17	1	43	8	35	8
Maximum	0.008	0.002	0.018	0.004	0.011	0.002	0.018	0.005	0.005	0.003	0.017	0.003	0.015	0.007	0.12	0.003	0.004	0.001	0.006	0.007	0.017	0.005
Minimum	ND	0.002	0.002	0.004	ND	0.002	ND	0.004	ND	0.003	0.003	0.003	0.004	0.007	0.002	0.002	ND	ND	0.002	0.002	0.001	0.002
Mean	0.003	0.002	0.004	0.004	0.003	0.002	0.005	0.004	0.004	0.003	0.006	0.003	0.008	0.007	0.005	0.003	0.001	ID	0.003	0.004	0.005	0.003
Standard Deviation	0.001	0.000	0.002	0.000	0.001	0.000	0.002	0.000	0.001	0.000	0.004	0.000	0.002	0.000	0.017	0.000	0.001	ID	0.001	0.001	0.004	0.001
Median	0.002	0.002	0.004	0.004	0.002	0.002	0.005	0.004	0.004	0.003	0.004	0.003	0.008	0.007	0.003	0.003	5E-04	ID	0.003	0.004	0.004	0.003
Dichlorodifluoromethane, ug/L																						
No. of Analyses	64	8	63	8	63	8	63	8	63	8	63	7	63	8	44	8	41	8	42	8	34	8
No. of Detections	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	2.31	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	5.99	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
cis 1,2-Dichloroethene, ug/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	14	5	69	7	0	0	0	0	9	7	0	0	0	0	43	7	0	0	0	0	0	0
Maximum	0.39	0.29	1.8	0.93	ND	ND	ND	ND	0.449	0.679	ND	ND	ND	ND	3.1	1.01	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	0.13	0.20	1.11	0.60	ID	ID	ID	ID	0.1	0.5	ID	ID	ID	ID	1.464	1.938	ID	ID	ID	ID	ID	ID
Standard Deviation	0.07	0.08	0.31	0.25	ID	ID	ID	ID	0.1	0.2	ID	ID	ID	ID	0.688	0.888	ID	ID	ID	ID	ID	ID
Median	0.1	0.24	1.1	0.659	ID	ID	ID	ID	0.1	0.575	ID	ID	ID	ID	1.50	2.00	ID	ID	ID	ID	ID	ID

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-21		MW-73		MW-84		MW-81		MW-99		MW-93		MW-95	
	Upgradient Northwest						Upgradient Northeast				Cross Gradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Potassium, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	1.6	1.17	1.6	0.859	1.3	1.07	0.86	0.791	1.2	0.908	1.9	1.65	1.4	1.27
Minimum	0.6	0.9	0.7	0.7	0.8	0.9	0.6	0.7	0.7	0.8	1.1	1.4	0.9	1.1
Mean	1.0	1.1	0.9	0.8	1.0	1.0	0.7	0.7	0.9	0.8	1.3	1.5	1.2	1.2
Standard Deviation	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.1
Median	0.9	1.1	0.8	0.8	0.945	0.993	0.7	0.7	0.9	0.8	1.3	1.6	1.1	1.2
Sodium, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	70	8	45	8	44	8	44	8	33	8	36	8	37	8
Maximum	7.2	6.34	7.8	5.7	6.7	6.04	7.5	5.55	16	10	9.4	9.12	7.8	6.04
Minimum	4.4	4.76	3.8	5.09	4.5	4.79	4.6	5.03	8.42	8.56	6.2	7.65	5.3	4.8
Mean	4.9	5.5	5.9	5.5	5.5	5.5	5.6	5.3	10.8	9.1	7.6	8.5	6.2	5.6
Standard Deviation	0.4	0.5	0.7	0.2	0.5	0.4	0.6	0.2	2.1	0.5	0.8	0.6	0.6	0.4
Median	4.8	5.5	6.0	5.5	5.5	5.6	5.6	5.3	9.9	9.2	7.5	8.6	6.1	5.7
Arsenic, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	24	0	1	0	0	0	10	0	33	8	35	8	5	0
Maximum	0.002	ND	0.001	ND	ND	ND	0.002	ND	0.007	0.003	0.002	0.002	0.001	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	0.003	0.002	ND	0.001	ND	ND
Mean	0.001	ID	ID	ID	ID	ID	0.001	ID	0.004	0.002	0.002	0.001	0.001	ID
Standard Deviation	0.000	ID	ID	ID	ID	ID	0.000	ID	0.001	0.000	0.000	0.000	0.000	ID
Median	5E-04	ID	ID	ID	ID	ID	0.001	ID	0.004	0.002	0.002	0.001	5E-04	ID
Barium, dissolved mg/L														
No. of Analyses	70	8	45	8	44	8	44	8	33	8	36	8	37	8
No. of Detections	69	8	45	8	44	8	44	8	33	8	35	8	37	8
Maximum	0.008	0.003	0.007	0.003	0.017	0.003	0.008	0.003	0.013	0.003	0.009	0.009	0.007	0.004
Minimum	ND	0.003	0.003	0.002	0.003	0.003	0.002	0.002	0.002	0.002	ND	0.007	0.003	0.003
Mean	0.004	0.003	0.004	0.003	0.004	0.003	0.004	0.003	0.005	0.002	0.007	0.008	0.004	0.003
Standard Deviation	0.001	0.000	0.001	0.000	0.002	0.000	0.001	0.000	0.003	0.000	0.001	0.001	0.001	0.000
Median	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.002	0.007	0.008	0.004	0.003
Dichlorodifluoromethane, ug/L														
No. of Analyses	61	8	44	8	44	8	43	8	111	11	35	8	37	8
No. of Detections	14	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	0.9	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	2.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
cis 1,2-Dichloroethene, ug/L														
No. of Analyses	70	8	45	8	44	8	44	8	111	11	36	8	37	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-24		MW-56		MW-57		MW-58A		MW-59		MW-60 Upgradient South		MW-65		MW-76		MW-82		MW-83		MW-94	
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Tetrachloroethene, ug/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	8	1	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.89	0.496	0.31	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.34	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.55	0.60	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.13	0.10	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.54	0.59	ID	ID	ID	ID	ID	ID
Trichloroethene, ug/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	0	0	0	0	1	0	0	0	1	0	0	0	0	0	45	8	41	8	43	8	35	8
Maximum	ND	ND	ND	ND	1.2	ND	ND	ND	0.45	ND	ND	ND	ND	ND	17	11.5	11	5.76	3.8	1.81	5.4	3.07
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.7	7.69	ND	4.14	0.504	1.03	1.1	1.03
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	12.17	13.88	7.50	0.10	2.14	9.23	3.51	0.10
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	2.15	2.17	1.82	0.00	0.60	1.11	1.01	0.00
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	11.40	13.50	7.35	0.1	2.1	9.5	3.7	0.1
Vinyl Chloride, ug/L																						
No. of Analyses	73	8	72	8	72	8	72	8	72	8	72	7	70	8	45	8	42	8	43	8	35	8
No. of Detections	1	0	0	0	0	0	0	0	0	0	0	0	56	8	0	0	0	0	0	0	1	0
Maximum	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.18	0.063	ND	ND	ND	ND	ND	ND	0.02	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.037	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0	0	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0	0	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.08	0.01	ID	ID	ID	ID	ID	ID	ID	ID

NOTES: * Well location groupings are relative to the flow paths of the Aquifer and the placement of Solid Waste.
ND = Not Detected

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-21		MW-73		MW-84		MW-81		MW-99		MW-93		MW-95	
	Upgradient Northwest						Upgradient Northeast				Cross Gradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Tetrachloroethene, ug/L														
No. of Analyses	70	8	45	8	44	8	44	8	111	11	36	8	37	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Trichloroethene, ug/L														
No. of Analyses	70	8	45	8	44	8	44	8	111	11	36	8	37	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Vinyl Chloride, ug/L														
No. of Analyses	70	8	45	8	44	8	44	8	111	11	36	8	37	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

NOTES: * Well location groupings are relative to the flow paths of the Aquifer and the placement of Solid Waste.
ND = Not Detected

Table 4-2a
Statistical Summary of Regional Aquifer
Groundwater Data

Well Location	MW-70		MW-77		MW-78		MW-100		MW-64		MW-66		MW-67		MW-68		MW-69		MW-72	
	Interior								Vertical to Key Facilities								Westside Downgradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field) Standard Units																				
No. of Analyses	71	8	45	7	41	8	37	8	70	7	69	8	70	8	62	8	69	7	49	8
No. of Detections	71	8	45	7	41	8	37	8	72	8	72	7	70	8	62	8	69	7	49	8
Maximum	8	7.5	7.3	7.0	7.3	6.6	7.1	7.6	8.7	7.1	7.5	7.1	8.5	7.1	8.7	7.3	8.2	7.6	7.5	7.3
Minimum	6.84	7.3	6.7	6.9	6.3	6.4	6.6	7.3	5.9	6.8	6.2	6.8	6.5	6.9	6.2	6.9	6.7	7.3	6.8	7.0
Mean	7.438	7.3	7.0	7.0	6.8	6.5	6.9	7.4	7.1	7.0	7.1	7.0	7.2	7.0	7.3	7.1	7.4	7.5	7.2	7.1
Standard Deviation	0.254	0.07	0.11	0.07	0.22	0.10	0.14	0.10	0.35	0.12	0.21	0.12	0.37	0.09	0.40	0.12	0.28	0.10	0.16	0.09
Median	7.48	7.3	7.0	7.0	6.8	6.5	6.9	7.4	7.1	6.9	7.1	7.0	7.2	7.0	7.3	7.0	7.4	7.5	7.3	7.1
Specific Conductance, (Field) micromhos/cm																				
No. of Analyses	71	8	45	7	41	8	37	8	70	7	69	8	70	8	62	8	70	7	49	8
No. of Detections	71	8	45	7	41	8	37	8	72	8	72	7	70	8	62	8	70	7	49	8
Maximum	280	205	330	315	220	180	360	313	250	185	500	215	245	308	357	322	320	286	340	292
Minimum	127	122	200	190	150	114	240	115	145	111	130	135	138	178	140	168	85	155	220	166
Mean	178	179	258	251	180	157	291	193	171	163	237	189	201	259	241	266	206	244	267	246
Standard Deviation	22	30	26	47	18	23	34	57	16	24	101	30	23	50	55	53	57	48	28	40
Median	175	188	260	255	180	167	300	190	170	171	198	200	202	267	240	285	220	264	255	245
Total Dissolved Solids, mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	68	8	70	8	61	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	61	8	70	7	50	8
Maximum	160.0	136	200	173	180	124	250	126	250	121	300	143	183	203	270	199	210	169	220	197
Minimum	46.0	111	80	141	96	113	130	111	27	98	31	117	65	182	74	159	40	126	130	158
Mean	109.9	123	160	156	126	119	180	120	103	109	150	125	132	190	153	173	132	160	174	177
Standard Deviation	18.60	8	21	11	16	4	27	6	25	9	60	8	23	8	41	13	37	15	25	13
Median	110.0	125	160	156	120	120	180	120	100	108	130	123	130	188	150	172	130	166	163	178
Alkalinity, total (CaCO3), mg/L																				
No. of Analyses	64	8	45	7	42	8	37	8	63	7	62	8	63	8	55	8	63	7	50	8
No. of Detections	64	8	45	7	42	8	37	8	63	8	63	7	63	8	55	8	63	7	50	8
Maximum	100	84	180	143	94	71	160	112	110	65	260	96	106	119	160	147	130	126	130	117
Minimum	63	72	120	109	69	65	95	73	54	61	60	83	54	79	46	130	56	119	26	105
Mean	77	79	137	119	80	69	132	80	67	62	102	88	80	109	118	136	100	123	110	114
Standard Deviation	7	4	14	11	7	2	14	13	7	1	43	5	11	14	36	6	23	3	14	4
Median	76	80	130	117	80	69	132	76	66	62	90	86	79	114	120	135	110	124	110	115
Ammonia as N, mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	69	7	50	8
No. of Detections	20	0	7	0	9	0	8	8	25	1	9	0	9	0	39	6	28	7	22	8
Maximum	0.3	ND	0.1	ND	0.1	ND	0.1	0.1	0.0	0.0	0.0	ND	0.5	ND	0.2	0.0	0.1	0.0	0.1	0.0
Minimum	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0	ND	0.0
Mean	0.0	ID	0.0	ID	0.0	ID	0.0	0.1	0.0	ID	0.0	ID	0.0	ID	0.0	0.0	0.0	0.0	0.0	0.0
Standard Deviation	0.07	ID	0.04	ID	0.01	ID	0.02	0.00	0.01	ID	0.03	ID	0.06	ID	0.02	0.00	0.03	0.00	0.02	0.00
Median	0.0	ID	0.0	ID	0.0	ID	0.0	0.1	0.0	ID	0.0	ID	0.0	ID	0.0	0.0	0.0	0.0	0.0	0.0
Chloride, mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	62	8	69	7	50	8
Maximum	7.0	7.7	5.1	5.1	6.1	4.9	5.9	4.5	6.3	4.4	5.0	2.9	9.0	5.1	6.8	3.1	5.0	4.8	4.3	4.5
Minimum	2.0	3.7	3.0	4.0	3.4	3.8	2.4	3.4	2.9	3.9	2.6	1.5	3.8	3.5	2.0	2.7	ND	4.0	2.0	3.5
Mean	3.3	4.4	4.0	4.8	4.8	4.2	3.3	3.7	3.9	4.1	3.4	2.5	5.3	4.6	3.1	2.9	3.1	4.3	3.6	3.9
Standard Deviation	0.7	1.3	0.5	0.4	0.6	0.4	0.6	0.4	1.1	0.2	0.6	0.5	1.4	0.5	0.7	0.1	0.9	0.3	0.5	0.3
Median	3.2	3.9	4.0	4.9	5.0	4.2	3.0	3.6	3.7	4.1	3.2	2.6	4.7	4.6	3.0	2.9	3.0	4.2	3.9	3.9

Table 4-2a
Statistical Summary of Regional Aquifer
Groundwater Data

Well Location	MW-74		MW-75		MW-80		MW-85		MW-87		MW-91		MW-86		MW-88		MW-89		MW-90		MW-43	
	Downgradient												Downgradient of Northhend Facilities									
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field) Standard Units																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	7.2	7.5	7.7	7.2	7.7	7.3	7.4	7.2	7.2	6.9	7.5	7.1	7.7	7.0	7.7	7.5	7.7	7.4	7.7	7.5	8.9	7.5
Minimum	6.7	7.0	6.7	7.0	7.0	7.0	6.7	6.9	6.7	6.7	6.8	6.9	6.6	6.8	6.8	7.0	7.0	7.1	7.0	7.1	5.8	7.1
Mean	7.0	7.1	7.1	7.0	7.2	7.2	7.1	7.1	6.9	6.9	7.1	7.0	7.0	6.9	7.2	7.2	7.3	7.3	7.3	7.2	7.4	7.3
Standard Deviation	0.12	0.17	0.19	0.07	0.23	0.12	0.15	0.11	0.12	0.07	0.15	0.09	0.20	0.09	0.20	0.17	0.16	0.11	0.18	0.14	0.40	0.14
Median	7.0	7.1	7.1	7.0	7.1	7.2	7.2	7.1	6.9	6.9	7.1	7.1	6.9	6.9	7.2	7.2	7.3	7.3	7.3	7.2	7.4	7.2
Specific Conductance, (Field) microm																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	420	467	315	308	265	285	240	266	380	431	260	280	220	188	125	135	220	203	195	212	190	179
Minimum	260	253	180	185	210	176	165	158	270	290	190	175	150	106	100	79	140	110	145	126	99	108
Mean	340	383	253	256	219	256	198	228	331	405	234	243	171	161	111	117	171	182	173	178	155	156
Standard Deviation	46	72	29	42	21	36	16	37	26	48	19	37	12	28	6	20	14	31	9	29	14	24
Median	340	365	255	245	210	267	200	234	340	420	233	255	170	173	110	123	170	192	170	183	155	160
Total Dissolved Solids, mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	43	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	43	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	265	291	260	204	237	182	157	170	290	322	244	806	150	109	96	85	150	129	142	145	130	122
Minimum	140	245	90	176	143	157	100	150	160	278	110	154	58	87	40	72	65	97	82	106	68	102
Mean	212	267	165	188	169	171	129	162	235	297	151	253	108	104	74	79	110	119	115	126	101	112
Standard Deviation	31	15	28	10	32	9	14	6	26	15	22	224	14	7	12	4	17	9	14	14	14	7
Median	210	266	170	191	156	174	130	162	230	295	150	176	110	106	77	79	110	122	120	124	100	110
Alkalinity, total (CaCO3), mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	63	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	63	8
Maximum	170	213	110	98	83	90	90	98	157	90	128	92	82	67	58	53	82	78	76	71	77	71
Minimum	97	163	74	95	74	78	65	84	47	80	68	85	50	61	48	50	67	74	52	64	31	64
Mean	130	190	91	97	79	85	81	92	92	87	87	87	68	65	52	52	73	76	67	69	70	69
Standard Deviation	21	18	8	1	3	4	7	4	13	3	9	3	5	2	2	1	4	1	5	2	6	2
Median	120	188	92	96	79	86	84	93	91	87	86	86	68	65	52	53	72	76	68	69	70	70
Ammonia as N, mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	10	0	11	1	3	3	5	0	16	8	13	8	6	0	5	0	23	8	12	8	37	8
Maximum	0.5	ND	0.1	0.1	0.0	0.0	0.2	ND	0.2	0.0	0.0	0.1	0.1	ND	0.1	ND	0.1	0.0	0.1	0.0	0.1	0.0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0	ND	0.0	ND	ND	ND	ND	ND	0.0	ND	0.0	ND	0.0
Mean	0.0	ID	0.0	ID	0.0	0.0	0.0	ID	0.0	0.0	0.0	0.0	0.0	ID	0.0	ID	0.0	0.0	0.0	0.0	0.0	0.0
Standard Deviation	0.09	ID	0.01	ID	0.00	0.00	0.03	ID	0.02	0.00	0.01	0.02	0.02	ID	0.02	ID	0.02	0.00	0.01	0.00	0.02	0.00
Median	0.0	ID	0.0	ID	0.0	0.0	0.0	ID	0.0	0.0	0.0	0.0	0.0	ID	0.0	ID	0.0	0.0	0.0	0.0	0.0	0.0
Chloride, mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	43	8	45	8	7	8	42	8	44	8	38	8	42	8	40	8	42	8	37	8	71	8
Maximum	35.0	31.1	8.5	8.9	5.3	5.5	10.0	7.4	4.5	5.5	9.0	8.4	7.6	4.7	2.8	2.9	5.2	7.0	3.9	4.2	3.2	3.7
Minimum	ND	20.5	3.3	7.7	4.8	4.6	4.0	6.1	2.0	4.4	2.0	7.3	3.1	4.0	ND	2.3	2.0	3.5	2.0	3.7	ND	2.9
Mean	23.0	23.8	6.4	8.2	5.0	5.0	5.4	6.8	2.8	4.8	7.5	7.5	5.0	4.2	2.1	2.5	2.6	4.1	2.7	3.8	2.0	3.2
Standard Deviation	7.9	3.2	1.7	0.4	0.2	0.3	1.0	0.4	0.9	0.4	1.2	0.4	1.0	0.2	0.4	0.2	0.7	1.2	0.7	0.2	0.5	0.3
Median	24.5	23.0	7.0	8.2	5.1	5.0	5.2	6.8	2.9	4.7	7.8	7.3	5.0	4.1	2.0	2.4	2.3	3.8	2.7	3.8	2.0	3.1

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-70		MW-77		MW-78		MW-100		MW-64		MW-66		MW-67		MW-68		MW-69		MW-72	
	Interior								Vertical to Key Facilities								Westside Downgradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Nitrate as N, mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	60	7	44	7	42	8	4	0	14	0	66	7	70	8	11	1	12	0	12	0
Maximum	0.2	0.0	1.6	1.0	2.0	0.9	0.3	ND	1.0	ND	4.9	1.4	3.6	0.6	0.7	0.0	0.3	ND	1.0	ND
Minimum	ND	ND	ND	0.8	0.6	0.8	ND	ND	ND	ND	ND	1.2	0.5	0.5	ND	ND	ND	ND	ND	ND
Mean	0.1	0.0	0.6	0.9	1.3	0.9	0.0	ID	0.0	ID	1.8	1.3	1.1	0.6	0.0	ID	0.0	ID	0.0	ID
Standard Deviation	0.06	0.01	0.31	0.04	0.26	0.06	0.07	ID	0.12	ID	0.88	0.10	0.53	0.05	0.09	ID	0.04	ID	0.14	ID
Median	0.1	0.0	0.5	0.9	1.3	0.9	0.0	ID	0.0	ID	1.8	1.3	0.9	0.6	0.0	ID	0.0	ID	0.0	ID
Sulfate, mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	62	8	69	7	50	8
Maximum	22	38	14	11	13	8	110	17	23	19	13	8	36	39	70	19	42	19	72	39
Minimum	10	17	8	8	7	7	18	15	14	17	6	7	18	17	10	16	ND	14	18	25
Mean	16	20	10	9	9	8	31	16	17	18	7	8	25	34	19	17	19	15	35	30
Standard Deviation	2	7	2	1	1	0	17	1	2	1	2	0	5	7	10	1	9	2	16	4
Median	16	17	10	9	9	8	23	16	17	17	7	8	24	35	16	16	16	15	27	29
Iron, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	59	0	37	0	38	0	37	8	72	8	67	4	67	8	62	8	70	7	50	8
Maximum	0.3	ND	1.0	ND	0.1	ND	3.4	1.2	7.5	4.6	0.4	0.0	8.5	0.1	3.8	2.3	3.2	1.2	2.9	2.2
Minimum	ND	ND	ND	ND	ND	ND	1.2	1.0	3.1	3.8	ND	ND	ND	0.0	0.6	1.0	0.1	0.7	0.0	1.7
Mean	0.0	ID	0.1	ID	0.1	ID	2.5	1.1	4.4	4.2	0.1	0.0	0.2	0.1	1.9	1.4	0.9	1.0	2.2	2.0
Standard Deviation	0.06	ID	0.15	ID	0.03	ID	0.49	0.08	0.52	0.27	0.07	0.01	1.01	0.03	0.75	0.45	0.55	0.16	0.44	0.16
Median	0.0	ID	0.1	ID	0.1	ID	2.5	1.0	4.3	4.1	0.1	0.0	0.1	0.1	2.0	1.3	0.8	1.0	2.1	2.0
Manganese, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	56	3	44	7	5	0	37	8	72	8	41	3	50	8	62	8	69	7	50	8
Maximum	0.110	0.028	0.062	0.021	0.010	ND	0.230	0.383	0.350	0.109	0.028	0.002	0.270	0.092	0.390	0.244	0.280	0.211	0.360	0.282
Minimum	ND	ND	ND	0.0	ND	ND	0.1	0.3	0.1	0.1	ND	ND	ND	0.0	0.1	0.2	ND	0.1	0.0	0.3
Mean	0.0	0.0	0.0	0.0	0.0	ID	0.1	0.4	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.2	0.3	0.3
Standard Deviation	0.03	0.01	0.01	0.00	0.00	ID	0.03	0.02	0.03	0.01	0.01	0.00	0.04	0.02	0.07	0.02	0.05	0.02	0.05	0.01
Median	0.0	0.0	0.0	0.0	0.0	ID	0.1	0.4	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.2	0.3	0.3
Calcium, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	62	8	70	7	50	8
Maximum	23	19	33	28	23	16	38	19	23	14	59	22	26	30	43	31	40	28	34	26
Minimum	13.0	16.4	19	20.8	13	13	23	15.4	12	12	12	16.0	15	25	15.0	24	11.0	22.6	18	23
Mean	18.0	17.4	26.6	23.9	17.6	14.4	28	17.2	14.3	13.1	26.9	18.2	19.0	27	23.9	27.7	21.7	26.6	25.1	24.7
Standard Deviation	2.5	0.7	3.4	2.6	2.6	0.8	4.1	1.4	1.7	0.4	13.7	1.8	2.8	1.5	6.7	2.0	6.9	1.9	3.5	0.9
Median	17.3	17.4	27	24	18	14.4	27	16.8	14	13	20.7	18.0	19.0	27.5	21	27.8	20	26.9	24	24.7
Magnesium, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	62	8	70	7	50	8
Maximum	13.0	10.8	17.0	15	10.0	6.9	21.0	9	13.0	9	25	11	15.4	18.8	22	16.7	18.0	14.4	19	16
Minimum	7.2	8.8	11.0	11.3	6.7	6.2	12.0	7.8	7.1	7.6	6.4	7.4	8.0	14.9	8.2	13.9	4.6	9.6	7.1	13
Mean	9.0	9.7	14.4	12.7	8.1	6.7	15.7	8.5	8.4	8.2	12.2	8.7	10.6	16.1	12.8	15.7	10.0	12.6	14.7	14.9
Standard Deviation	1.1	0.6	1.5	1.5	0.9	0.3	2.3	0.6	0.9	0.4	5.9	1.1	1.6	1.2	3.4	1.0	3.1	1.6	2.2	0.9
Median	8.9	9.6	15.0	12	8.0	6.8	15	8.4	8.3	8.3	9.6	8.4	10	15.8	12.0	15.9	9.4	13.2	14.0	15

Table 4-2a
Statistical Summary of Regional Aquifer
Groundwater Data

Well Location	MW-74		MW-75		MW-80		MW-85		MW-87		MW-91		MW-86		MW-88		MW-89		MW-90		MW-43	
	Downgradient												Downgradient of Northhend Facilities									
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Nitrate as N, mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	31	7	7	1	0	0	42	8	10	3	13	8	36	8	41	8	7	0	4	0	12	0
Maximum	1.4	0.5	2.0	0.0	ND	ND	0.2	0.1	0.2	0.0	1.0	0.0	2.5	0.4	1.7	0.6	0.2	ND	1.4	ND	0.4	ND
Minimum	ND	ND	ND	ND	ND	ND	0.0	0.1	ND	ND	ND	0.0	ND	0.1	ND	0.5	ND	ND	ND	ND	ND	ND
Mean	0.4	0.4	0.1	ID	ID	ID	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.5	0.0	ID	0.1	ID	0.0	ID
Standard Deviation	0.49	0.16	0.30	ID	ID	ID	0.03	0.01	0.04	0.01	0.17	0.01	0.38	0.13	0.24	0.03	0.03	ID	0.28	ID	0.05	ID
Median	0.1	0.4	0.0	ID	ID	ID	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.5	0.0	ID	0.0	ID	0.0	ID
Sulfate, mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	40	8	42	8	37	8	71	8
Maximum	29	27	54	48	43	46	32	32	115	134	44	40	30	19	8	7	21	17	29	28	20	14
Minimum	5	21	16	42	32	41	16	30	72	112	4	33	10	16	ND	6	15	15	2	24	ND	14
Mean	24	23	40	44	37	43	24	31	93	121	31	37	18	17	6	7	17	16	23	26	13	14
Standard Deviation	4	2	6	2	5	2	5	1	10	8	7	2	2	1	1	0	1	1	4	1	2	0
Median	25	23	41	44	37	43	25	31	93	120	32	36	18	17	6	7	16	16	24	26	13	14
Iron, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	5	45	8	7	8	34	0	44	8	38	8	42	8	34	0	42	8	37	8	72	8
Maximum	2.8	1.7	3.8	1.7	1.51	1.68	0.22	ND	3.10	3.26	2.44	2.88	2.00	0.56	2.90	ND	0.87	0.85	1.20	1.29	1.70	0.99
Minimum	0.0	ND	1.10	1.4	0.9	1.3	ND	ND	0.3	2.7	0.4	0.9	0.0	0.2	ND	ND	0.5	0.7	0.9	1.1	0.0	0.9
Mean	1.3	0.8	1.8	1.5	1.2	1.5	0.1	ID	2.7	3.1	2.0	2.3	0.4	0.4	0.1	ID	0.7	0.8	1.0	1.1	1.0	0.9
Standard Deviation	1.00	0.72	0.44	0.11	0.24	0.11	0.05	ID	0.44	0.22	0.32	0.62	0.28	0.11	0.44	ID	0.06	0.05	0.10	0.07	0.24	0.04
Median	1.6	1.1	1.7	1.5	1.3	1.5	0.1	ID	2.7	3.1	2.1	2.5	0.4	0.3	0.0	ID	0.7	0.8	1.0	1.1	1.0	0.9
Manganese, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	5	45	8	7	8	6	4	44	8	38	8	41	8	13	1	42	8	37	8	72	8
Maximum	0.176	0.131	0.170	0.130	0.272	0.276	0.003	0.001	0.350	0.380	0.290	0.405	0.250	0.026	0.310	0.001	0.400	0.262	0.380	0.286	0.250	0.235
Minimum	0.0	ND	0.07	0.11	0.2	0.2	ND	ND	0.0	0.3	0.0	0.2	ND	0.0	ND	ND	0.3	0.2	0.2	0.2	0.0	0.2
Mean	0.1	0.1	0.1	0.1	0.2	0.3	0.0	0.0	0.3	0.4	0.2	0.3	0.0	0.0	0.0	ID	0.3	0.3	0.3	0.3	0.2	0.2
Standard Deviation	0.06	0.05	0.02	0.01	0.03	0.01	0.00	0.00	0.05	0.02	0.04	0.06	0.04	0.01	0.05	ID	0.03	0.01	0.03	0.02	0.03	0.01
Median	0.1	0.1	0.1	0.1	0.2	0.3	0.0	0.0	0.3	0.4	0.2	0.3	0.0	0.0	0.0	ID	0.3	0.3	0.3	0.3	0.2	0.2
Calcium, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	39	40	31	23	27	26	35	23	35	37	25	22	21	14	30	9	18	14	19	17	16	14
Minimum	19	22	11	21	18	23.4	8.4	20	4	33	15.0	19	11	12	7.4	8	10.0	13	14.0	15	1.2	12
Mean	28.7	35.3	19.2	22.0	22.3	24.8	18.7	21.2	28.1	34.7	21	21	14.1	12.9	9	9	13	13	16	16	12.7	12.6
Standard Deviation	5.3	5.7	4.1	0.8	3.0	1.1	4.3	0.8	5.2	1.3	2.1	0.7	1.7	0.8	3.8	0.3	1.3	0.6	1.1	0.5	1.8	0.6
Median	29	37.1	21	22.0	23	24.8	19	21	29.3	34.8	21	21	14	13	9	9	13	13	16	16	13	12.5
Magnesium, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	27	31	21	17	14	13.8	21.0	15.5	23.4	25	15.0	14.2	12	10	19.0	6.5	10.2	10.9	10.0	10.0	10	8.9
Minimum	15.0	17.4	8.5	15.9	9.5	11.3	6.4	12.1	11.0	21.1	9.6	12.8	8	7	4.9	5.9	7.0	8.8	7.3	8.7	2.8	8.2
Mean	20.6	27.0	14	16.7	11.7	12.3	11.4	13.2	19	23.6	12.7	13.6	9	8.6	6.6	6.2	8.6	9.6	8.7	9.3	8.6	8.6
Standard Deviation	3.2	4.3	2.8	0.5	1.4	0.9	2.3	1.1	2.5	1.2	1.1	0.4	1.0	0.9	2.2	0.3	0.8	0.6	0.8	0.5	1.0	0.3
Median	20	27.9	15	16.8	12.0	12.3	11.0	13.2	19.0	23.7	13.0	13.6	9	8.5	6.3	6.2	8.7	9.4	8.7	9.2	8.7	8.6

Table 4-2a
Statistical Summary of Regional Aquifer
Groundwater Data

Well Location	MW-70		MW-77		MW-78		MW-100		MW-64		MW-66		MW-67		MW-68		MW-69		MW-72	
	Interior								Vertical to Key Facilities								Westside Downgradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Potassium, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	62	8	70	7	50	8
Maximum	1.5	1.52	2.4	1.62	2.5	2.11	2.1	1.16	3.3	1.14	2.3	1.33	1.7	1.64	2.2	1.78	1.9	1.76	2.4	1.85
Minimum	1.1	1.3	1.3	1.3	1.7	1.8	1.4	0.9	0.6	0.9	0.9	1.0	0.8	1.5	0.7	1.6	0.6	1.4	1.1	1.6
Mean	1.3	1.4	1.5	1.5	2.1	2.0	1.7	1.0	1.0	1.0	1.3	1.2	1.2	1.5	1.5	1.7	1.4	1.6	1.7	1.7
Standard Deviation	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.3	0.1	0.4	0.1	0.2	0.1	0.2	0.1	0.3	0.1	0.2	0.1
Median	1.3	1.5	1.5	1.5	2.1	2.0	1.7	1.0	1.0	1.0	1.2	1.2	1.2	1.6	1.4	1.7	1.4	1.6	1.7	1.8
Sodium, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	71	8	45	7	42	8	37	8	72	8	72	7	70	8	62	8	70	7	50	8
Maximum	8.4	6.4	10	8.8	7.9	6.08	11	5.78	7.6	5.67	14	6.47	12.6	8.78	10	8.7	8.8	8.08	8.7	7.52
Minimum	4.7	5.64	7	7.27	5.2	5.6	7.5	4.97	4.73	4.91	4.7	5.06	5.9	8.26	5	7.05	4.7	5.88	6.1	6.08
Mean	5.8	6.1	8.6	7.8	6.1	5.9	8.7	5.4	5.6	5.3	6.9	5.7	7.3	8.5	7.3	8.2	6.5	7.3	7.1	6.9
Standard Deviation	0.6	0.3	0.7	0.6	0.6	0.2	0.7	0.3	0.5	0.3	2.0	0.5	0.9	0.2	1.0	0.5	1.0	0.8	0.7	0.4
Median	5.7	6.1	8.6	7.5	5.8	5.9	8.6	5.4	5.6	5.3	6.0	5.7	7.1	8.5	7.2	8.3	6.5	7.5	6.9	7.1
Arsenic, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	69	8	62	8	70	7	50	8
No. of Detections	7	0	0	0	3	0	0	0	2	0	1	0	3	0	21	0	69	7	0	0
Maximum	0.002	ND	ND	ND	0.002	ND	ND	ND	0.001	ND	0.001	ND	0.003	ND	0.005	ND	0.005	0.002	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND
Mean	0.001	ID	ID	ID	0.001	ID	ID	ID	ID	ID	ID	ID	0.001	ID	0.001	ID	0.003	0.002	ID	ID
Standard Deviation	0.000	ID	ID	ID	0.0003	ID	ID	ID	ID	ID	ID	ID	0.000	ID	0.001	ID	0.001	0.000	ID	ID
Median	0.001	ID	ID	ID	5E-04	ID	ID	ID	ID	ID	ID	ID	5E-04	ID	0.001	ID	0.002	0.002	ID	ID
Barium, dissolved mg/L																				
No. of Analyses	71	8	45	7	42	8	37	8	70	7	69	8	69	8	62	8	70	7	50	8
No. of Detections	69	8	45	7	41	8	36	8	71	8	72	7	68	8	62	8	70	7	50	8
Maximum	0.017	0.002	0.008	0.004	0.005	0.002	0.013	0.005	0.005	0.003	0.017	0.003	0.015	0.009	0.018	0.013	0.018	0.011	0.017	0.01
Minimum	ND	0.002	0.003	0.003	ND	0.002	ND	0.004	ND	0.003	0.003	0.003	ND	0.008	0.005	0.011	0.004	0.009	0.008	0.009
Mean	0.003	0.002	0.004	0.003	0.002	0.002	0.009	0.004	0.004	0.003	0.006	0.003	0.006	0.008	0.012	0.012	0.009	0.011	0.011	0.010
Standard Deviation	0.002	0.000	0.001	0.001	0.001	0.000	0.002	0.000	0.001	0.000	0.004	0.000	0.002	0.000	0.003	0.001	0.003	0.001	0.002	0.000
Median	0.002	0.002	0.004	0.003	0.002	0.002	0.008	0.004	0.004	0.003	0.004	0.003	0.006	0.008	0.012	0.013	0.009	0.011	0.01	0.01
Dichlorodifluoromethane, ug/L																				
No. of Analyses	64	8	46	7	42	8	38	8	63	7	63	8	63	8	55	8	63	7	50	8
No. of Detections	0	0	8	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	0.45	ND	0.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	0.15	ID	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	0.11	ID	0.0	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	0.1	ID	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
cis 1,2-Dichloroethene, ug/L																				
No. of Analyses	71	8	46	7	42	8	38	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	0	0	0	0	0	0	0	0	9	7	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	0.449	0.679	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.1	0.5	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.1	0.2	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.1	0.575	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

Table 4-2a
Statistical Summary of Regional Aquifer
Groundwater Data

Well Location	MW-74		MW-75		MW-80		MW-85		MW-87		MW-91		MW-86		MW-88		MW-89		MW-90		MW-43	
	Downgradient												Downgradient of Northhend Facilities									
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Potassium, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	2.5	2.2	2.3	1.78	1.56	1.62	2.3	1.51	2.27	2.19	1.9	1.72	1.6	1.26	2	0.892	1.6	1.56	1.4	1.43	2.1	1.39
Minimum	1.4	1.8	0.8	1.5	1.3	1.5	0.8	1.2	1.3	1.9	1.2	1.5	0.9	1.0	0.7	0.8	1.2	1.3	1.1	1.2	0.9	1.2
Mean	1.9	2.0	1.6	1.7	1.4	1.5	1.3	1.4	1.8	2.1	1.5	1.7	1.1	1.1	0.9	0.8	1.4	1.5	1.2	1.3	1.3	1.3
Standard Deviation	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.2	0.1
Median	1.9	2.0	1.6	1.7	1.4	1.6	1.26	1.35	1.9	2.1	1.5	1.7	1.1	1.2	0.8	0.8	1.4	1.5	1.2	1.3	1.3	1.3
Sodium, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
Maximum	11.2	12.7	46	8.72	7.77	6.91	8	8.11	10	9.99	8.2	7.79	7.4	6.76	8.6	5.48	9.8	8.57	7	6.41	6.9	6.12
Minimum	7.7	8.23	5.3	7.39	5.74	5.8	4.6	6.9	7.1	8.45	6.1	6.69	5.5	5.16	4.3	4.8	6.3	7.44	4.9	5.3	5.2	5.54
Mean	9.3	11.3	11.5	8.0	6.7	6.5	6.9	7.4	8.3	9.1	6.9	7.3	6.3	5.9	5.4	5.2	7.9	8.1	5.8	5.9	6.1	5.9
Standard Deviation	0.9	1.5	9.3	0.4	0.7	0.4	0.7	0.5	0.7	0.5	0.5	0.4	0.5	0.6	0.7	0.2	0.9	0.3	0.5	0.4	0.4	0.2
Median	9.2	11.7	7.8	7.9	6.7	6.6	6.8	7.3	8.3	9.1	6.7	7.3	6.3	6.0	5.4	5.3	8.1	8.2	5.7	5.9	6.1	5.9
Arsenic, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	27	0	42	0	7	0	10	0	2	0	37	8	1	0	28	7	41	8	0	0	6	0
Maximum	0.003	ND	0.007	ND	0.005	ND	0.002	ND	0.003	ND	0.006	0.004	0.003	ND	0.001	0.001	0.007	0.002	ND	ND	0.002	ND
Minimum	ND	ND	ND	ND	0.004	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND
Mean	0.001	ID	0.002	ID	0.005	ID	0.001	ID	ID	ID	0.004	0.002	ID	ID	0.001	0.001	0.003	0.001	ID	ID	0.0006	ID
Standard Deviation	0.001	ID	0.001	ID	0.000	ID	0.000	ID	ID	ID	0.001	0.001	ID	ID	0.000	0.000	0.002	0.000	ID	ID	0.0003	ID
Median	0.001	ID	0.002	ID	0.005	ID	0.001	ID	ID	ID	0.004	0.002	ID	ID	0.001	0.001	0.002	0.001	ID	ID	5E-04	ID
Barium, dissolved mg/L																						
No. of Analyses	44	8	45	8	7	8	42	8	44	8	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	44	8	45	8	7	8	42	8	44	8	38	8	41	8	42	8	41	8	37	8	72	8
Maximum	0.019	0.016	0.02	0.009	0.013	0.005	0.023	0.005	0.019	0.02	0.012	0.01	0.008	0.005	0.006	0.002	0.009	0.006	0.008	0.006	0.012	0.007
Minimum	0.008	0.009	0.002	0.008	0.01	0.004	0.004	0.004	0.014	0.018	0.005	0.009	ND	0.004	0.002	0.002	ND	0.006	0.005	0.005	0.003	0.006
Mean	0.013	0.013	0.010	0.009	0.011	0.012	0.005	0.005	0.017	0.019	0.009	0.009	0.005	0.004	0.003	0.002	0.007	0.006	0.005	0.005	0.007	0.006
Standard Deviation	0.003	0.003	0.003	0.000	0.001	0.000	0.003	0.000	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Median	0.014	0.013	0.009	0.009	0.011	0.012	0.004	0.004	0.017	0.019	0.009	0.009	0.005	0.004	0.002	0.002	0.007	0.006	0.005	0.005	0.007	0.006
Dichlorodifluoromethane, ug/L																						
No. of Analyses	129	11	128	11	35	8	43	8	127	11	38	8	42	8	41	8	41	8	37	8	65	8
No. of Detections	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
Maximum	ND	ND	ND	ND	0.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.2	ID
Standard Deviation	ID	ID	ID	ID	0.0	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.3	ID
Median	ID	ID	ID	ID	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.1	ID
cis 1,2-Dichloroethene, ug/L																						
No. of Analyses	129	11	128	11	35	8	43	8	127	11	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	0.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-70		MW-77		MW-78		MW-100		MW-64		MW-66		MW-67		MW-68		MW-69		MW-72	
	Interior								Vertical to Key Facilities								Westside Downgradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Tetrachloroethene, ug/L																				
No. of Analyses	71	8	46	7	42	8	38	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Trichloroethene, ug/L																				
No. of Analyses	71	8	46	7	42	8	38	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	0	0	0	0	19	7	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	0.62	0.613	ND	ND	0.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	0.26	0.22	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	0.20	0.19	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	0.10	0.10	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Vinyl Chloride, ug/L																				
No. of Analyses	71	8	46	7	42	8	38	8	70	7	69	8	70	8	62	8	70	7	50	8
No. of Detections	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Maximum	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

NOTES: * Well location groupings are relative to the flow paths of the Aquifer and the placement of Solid Waste.
ND = Not Detected

Table 4-2a
Statistical Summary of Regional Aquifer Groundwater Data

Well Location	MW-74		MW-75		MW-80		MW-85		MW-87		MW-91		MW-86		MW-88		MW-89		MW-90		MW-43	
	Downgradient												Downgradient of Northhend Facilities									
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Tetrachloroethene, ug/L																						
No. of Analyses	129	11	128	11	35	8	43	8	127	11	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Trichloroethene, ug/L																						
No. of Analyses	129	11	128	11	35	8	43	8	127	11	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	0	0	0	0	10	0	0	7	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Maximum	ND	ND	ND	ND	0.61	ND	ND	1.81	ND	ND	0.23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	0.14	ID	ID	0.1	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	0.10	ID	ID	0.0	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	0.10	ID	ID	0	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Vinyl Chloride, ug/L																						
No. of Analyses	129	11	128	11	35	8	43	8	127	11	38	8	42	8	42	8	42	8	37	8	72	8
No. of Detections	0	0	2	0	1	0	0	0	2	0	0	0	0	0	1	0	1	0	0	0	9	1
Maximum	ND	ND	0.07	ND	0.02	ND	ND	ND	0.08	ND	ND	ND	ND	ND	0.03	ND	0.04	ND	ND	ND	0.07	0.025
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.02	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.03	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	0.01	ID

NOTES: * Well location groupings are relative to the flow paths of the Aquifer and the placement of Solid Waste.
ND = Not Detected

Table 4-2b
Statistical Summary of Perched Zones Groundwater Data

Well Location	MW-27A		MW-28		MW-29		MW-55		MW-30A		MW-47		MW-62		MW-EB6		MW-101	MW-101
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Zone	North and West Perched Zones								East Perched Zone								SSWA	
pH, (Field) Standard Units																		
No. of Analyses	72	8	60	7	70	8	72	8	78	8	78	8	47	4	35	5	11	8
No. of Detections	72	8	60	7	70	8	72	8	78	8	78	8	47	4	35	5	11	8
Maximum	8.3	8.0	7.6	5.8	7.9	6.5	8.6	7.9	7.4	6.5	7.5	7.1	7.5	6.4	7.6	6.4	6.9	7.2
Minimum	5.9	7.7	5.4	5.5	5.8	5.9	6.9	7.5	5.8	6.1	6.4	6.9	6.1	6.1	5.6	5.2	6.6	6.8
Mean	7.6	7.8	6.1	5.6	6.6	6.2	7.8	7.7	6.5	6.3	7.0	6.9	6.8	6.2	6.7	6.0	6.8	7.1
Standard Deviation	0.46	0.10	0.43	0.10	0.50	0.20	0.30	0.12	0.30	0.11	0.20	0.08	0.34	0.15	0.48	0.48	0.08	0.11
Median	7.7	7.8	6.1	5.7	6.5	6.3	7.8	7.8	6.5	6.3	7.0	6.9	6.8	6.2	6.7	6.1	6.8	7.1
Specific Conductance, (Field) uS/cm																		
No. of Analyses	72	8	60	7	70	8	72	8	77	8	78	8	47	4	35	5	12	8
No. of Detections	72	8	60	7	70	8	72	8	111	8	78	8	47	4	35	5	12	8
Maximum	185	223	242	119	108	87	160	165	469	380	1047	1090	324	257	710	240	827	778
Minimum	87	138	95	73	68	70	112	104	70	218	8	638	50	200	100	140	250	429
Mean	155	179	141	100	83	80	131	144	246	318	809	837	245	228	249	182	646	657
Standard Deviation	16	33	38	17	7	7	10	20	120	60	136	183	49	27	118	38	149	109
Median	157	180	125	100	84	81	130	150	280	338	826	740	250	228	209	180	673	663
Total Dissolved Solids, mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	47	4	27	5	11	8
No. of Detections	72	8	60	7	71	8	72	8	78	8	78	8	47	4	27	5	11	8
Maximum	500	145	180	125	3100	364	130	121	350	237	1500	702	240	146	560	156	490	457
Minimum	27.0	123.0	47.0	70.0	40.0	62	58	103	120	206	120	600	95	122	29	102	162	392
Mean	117.2	132.4	99.8	86.1	145.1	117.9	97.6	114.3	226.6	225.4	537.5	640.8	166.7	136.0	166.1	133.4	439.1	428.4
Standard Deviation	51.40	7.05	26.36	17.79	371	104	14.69	5.47	39.54	9.81	132	35.3	27.93	10.07	99.0	21.01	93.02	19.49
Median	110	134	99	82	78	74	98	115	220	225	520	639	170	138	144	131	460	435
Alkalinity, total (CaCO3), mg/L																		
No. of Analyses	63	8	53	7	62	8	63	8	63	8	63	8	41	4	23	5	11	8
No. of Detections	63	8	53	7	62	8	63	8	63	8	63	8	41	4	23	5	11	8
Maximum	90	83	71	34	48	31	68	68	200	194	920	676	110	85	600	109	520	437
Minimum	29	73	24	28	21	22	52	59	66	175	400	597	42	63	64	75	122	381
Mean	79	80	37	30	26	26	60	64	137	184	536	643	70	74	156	89	410	406
Standard Deviation	8	3	12	2	4	3	4	3	38	8	77	29	15	9	138	13	121	23
Median	80	81	34	29	26	26	59	63	150	185	530	652	68	75	102	87	450	403
Ammonia as N, mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	47	4	21	5	11	8
No. of Detections	72	8	23	0	18	0	65	8	15	0	59	8	7	0	21	5	5	8
Maximum	0.26	0.19	0.22	ND	0.12	ND	0.12	0.07	0.29	ND	0.16	0.07	0.03	ND	1.90	2.95	0.1	0.0
Minimum	0.0	0.2	ND	ND	ND	ND	ND	0.0	ND	ND	ND	0.0	ND	ND	0.1	1.3	ND	0.0
Mean	0.15	0.17	0.02	ID	0.01	ID	0.05	0.06	0.02	ID	0.05	0.06	0.01	ID	0.94	2.08	0.03	0.02
Standard Deviation	0.05	0.02	0.04	ID	0.02	ID	0.02	0.01	0.04	ID	0.04	0.01	0.01	ID	0.51	0.59	0.03	0.00
Median	0.2	0.2	0.0	ID	0.0	ID	0.1	0.1	0.0	ID	0.0	0.1	0.0	ID	0.8	2.0	0.0	0.0
Chloride, mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	47	4	24	5	11	8
No. of Detections	72	8	60	7	70	8	72	8	77	8	78	8	47	4	20	5	11	8
Maximum	43.0	8.0	5.0	4.3	14.0	3.8	2.5	3.7	10.3	3.1	26.0	8.2	30.0	9.0	33.0	1.5	8.9	5.4
Minimum	1.0	5.7	2.0	3.2	ND	2.7	1.6	1.8	ND	1.7	3.8	6.8	3.0	5.4	ND	0.8	3.3	4.4
Mean	2.5	6.6	3.1	3.7	3.6	3.2	2.0	2.2	3.2	2.4	13.1	7.6	11.1	7.3	2.8	1.0	7.4	4.8
Standard Deviation	5.09	0.87	0.67	0.43	1.83	0.34	0.14	0.66	2.67	0.48	5.68	0.43	6.69	1.54	6.47	0.31	1.75	0.34
Median	1.5	6.7	3.0	3.6	3.0	3.2	2.0	1.9	2.0	2.4	10.5	7.7	9.0	7.5	1.4	1.0	8.0	4.8

Table 4-2b
Statistical Summary of Perched Zones
Groundwater Data

Well Location	MW-27A		MW-28		MW-29		MW-55		MW-30A		MW-47		MW-62		MW-EB6		MW-101	MW-101
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Zone	North and West Perched Zones								East Perched Zone								SSWA	
Nitrate as N, mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	47	4	22	5	11	8
No. of Detections	32	7	52	7	69	8	8	2	77	8	9	0	47	4	9	2	1	0
Maximum	1.1	0.2	1.2	0.5	5.1	2.3	0.1	0.0	22.0	0.7	1.1	ND	12.0	3.6	0.1	0.0	0.0	ND
Minimum	ND	ND	ND	0.1	ND	1.2	ND	ND	ND	0.3	ND	ND	3.0	2.6	ND	ND	ND	ND
Mean	0.1	0.1	0.4	0.3	2.4	1.8	0.0	ID	4.2	0.4	0.0	ID	5.7	3.0	0.0	ID	ID	ID
Standard Deviation	0.16	0.06	0.31	0.17	0.86	0.41	0.01	ID	4.85	0.14	0.13	ID	1.83	0.40	0.04	ID	ID	ID
Median	0.01	0.08	0.4	0.2	2.4	1.9	0.00	ID	2.3	0.4	0.00	ID	5.4	3.0	0.0	ID	ID	ID
Sulfate, mg/L																		
No. of Analyses	72	8	59	7	71	8	72	8	78	8	78	8	47	4	24	5	11	8
No. of Detections	72	8	59	7	70	8	72	8	78	8	78	8	47	4	15	3	11	8
Maximum	16.5	14.1	59.5	16.1	4.0	2.0	27.0	14.3	65.0	11.8	13.9	7.3	41.0	17.7	8.0	25.2	20.9	5.6
Minimum	1.6	10.6	14.0	13.7	ND	1.6	9.0	10.7	2.0	8.8	1.6	6.7	16.7	14.7	ND	ND	5.2	5.0
Mean	7.6	12.3	27.5	15.2	2.0	1.8	10.7	11.9	23.0	10.1	6.9	7.0	25.9	15.9	1.5	5.1	8.0	5.2
Standard Deviation	1.94	1.32	11.43	1.05	0.62	0.12	2.10	1.07	9.47	1.12	1.94	0.23	4.95	1.42	2.04	11.22	4.78	0.19
Median	7.1	12.0	23.0	15.7	2.0	1.8	10.0	11.8	22.8	9.9	6.8	7.0	26.0	15.6	0.4	0.1	6.3	5.2
Iron, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	61	0	52	1	63	0	72	8	65	1	76	8	43	1	33	4	11	8
Maximum	0.2	ND	1.11	0.02	34.0	ND	0.6	0.3	0.5	0.0	3.0	0.6	1.7	0.0	29.3	28.0	3.5	1.3
Minimum	ND	ND	ND	ND	ND	ND	0.0	0.2	ND	ND	0.0	0.1	ND	ND	0.5	2.0	0.5	0.2
Mean	0.0	ID	0.1	ID	0.8	ID	0.2	0.3	0.1	ID	0.6	0.3	0.1	ID	10.8	12.3	1.6	0.4
Standard Deviation	0.04	ID	0.19	ID	4.16	ID	0.08	0.05	0.09	ID	0.60	0.16	0.28	ID	7.57	11.12	0.92	0.36
Median	0.0	ID	0.0	ID	0.0	ID	0.2	0.2	0.1	ID	0.4	0.3	0.1	ID	8.9	9.5	1.5	0.3
Manganese, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	58	3	42	0	72	8	21	0	78	8	12	0	33	4	11	8
Maximum	0.2	0.1	4.2	0.0	0.5	ND	0.2	0.2	0.1	ND	2.8	2.2	0.0	ND	3.0	1.1	2.00	1.70
Minimum	0.0	0.0	ND	ND	ND	ND	0.0	0.1	ND	ND	0.5	1.4	ND	ND	0.2	0.7	0.2	1.2
Mean	0.1	0.1	0.9	0.0	0.0	ID	0.1	0.2	0.0	ID	1.1	1.6	0.0	ID	1.0	0.9	1.5	1.4
Standard Deviation	0.02	0.01	1.23	0.00	0.07	ID	0.02	0.01	0.01	ID	0.45	0.29	0.01	ID	0.58	0.15	0.47	0.19
Median	0.1	0.1	0.1	0.0	0.0	ID	0.1	0.1	0.0	ID	1.0	1.5	0.0	ID	0.8	0.8	1.7	1.4
Calcium, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
Maximum	24.7	22.9	25.2	10.6	12	8	17	13	55	33	160	137	32	24	29	14	98	77
Minimum	2.8	19.2	8.5	8.5	6	6	2	12	6	27	63	117	16	19	5	11	24	60
Mean	18.1	20.9	14.4	9.5	8	7	12	12	31	30	105	127	23	21	14	13	72	67
Standard Deviation	3.03	1.23	4.42	0.86	1	1	2	0	9	2	17	6	4	3	6	1	18	6
Median	19.0	20.8	13.0	9.0	8	7	12	12	30	31	107	128	23	20	13	13	74	65
Magnesium, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
Maximum	6.41	6.64	8.6	2.86	6.3	2.2	7.6	7.1	31.0	21.5	64.0	69.7	12.0	6.8	12.9	8.1	50.0	43.9
Minimum	2.1	5.4	2.0	2.2	1.5	1.5	3.4	5.9	1.7	15.0	31.0	56.7	4.4	4.9	2.7	5.9	15.3	36.8
Mean	4.9	5.9	3.4	2.4	2.1	1.8	5.7	6.4	17.9	17.7	49.9	61.8	7.9	5.8	6.7	6.8	39.8	39.6
Standard Deviation	0.65	0.42	1.16	0.27	0.6	0.2	0.6	0.4	5.2	2.1	6.6	4.3	1.8	0.9	2.4	0.9	9.3	2.7
Median	4.80	5.95	3.10	2.25	1.9	1.8	5.7	6.3	17.0	17.7	49.9	61.1	7.8	5.7	6.3	6.7	42.0	38.6

Table 4-2b
Statistical Summary of Perched Zones Groundwater Data

Well Location	MW-27A		MW-28		MW-29		MW-55		MW-30A		MW-47		MW-62		MW-EB6		MW-101	MW-101
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Zone	North and West Perched Zones								East Perched Zone								SSWA	
Potassium, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	60	7	67	8	72	8	78	8	78	8	48	4	33	4	11	8
Maximum	15	3.9	4.6	1.12	1.6	0.613	2.2	1.82	7.2	1.93	24	5.36	1.6	1.2	2.8	1.92	3.7	3.52
Minimum	1.28	3.51	0.9	0.861	ND	0.48	1.00	1.57	0.53	1.69	3.70	4.54	0.70	0.86	1.00	1.55	1.92	2.86
Mean	3.4	3.7	1.2	1.0	0.6	0.5	1.56	1.67	1.8	1.8	5.13	4.93	1.14	1.02	1.54	1.73	2.9	3.2
Standard Deviation	1.4	0.1	0.6	0.1	0.2	0.1	0.2	0.1	0.7	0.1	2.2	0.3	0.2	0.1	0.4	0.2	0.4	0.2
Median	3.3	3.7	1	0.931	0.6	0.5	1.5	1.7	1.7	1.8	4.9	5.0	1.1	1.0	1.5	1.7	2.9	3.1
Sodium, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
Maximum	7.96	7.24	10.6	7.22	7.6	5.3	6.9	6.13	20	16.5	21	19.3	20	15.6	350	13.9	25	17
Minimum	3.01	5.96	5.02	5.7	3.5	4.23	4.7	4.97	4.3	13.6	13	14.5	12.4	13.3	8.9	10.2	9.05	14.7
Mean	6.5	6.8	7.5	6.2	5.0	4.6	5.6	5.6	13.5	15.4	16.3	17.4	15.4	14.4	32.3	12.0	17.7	15.8
Standard Deviation	0.68	0.41	1.29	0.56	0.79	0.37	0.44	0.41	1.80	0.93	1.72	1.49	1.70	1.00	60.99	1.63	4.02	0.79
Median	6.5	6.8	7.2	5.9	4.8	4.5	5.5	5.5	13.0	15.6	16.0	17.7	15.0	14.3	14.0	11.9	18.0	15.9
Arsenic, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	1	0	5	0	2	0	4	0	67	4	1	0	33	4	10	8
Maximum	0.019	0.017	0.002	ND	0.009	ND	0.001	ND	0.013	ND	0.006	0.002	0.001	ND	0.016	0.01	0.0129	0.0155
Minimum	0.005	0.016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	0.0011	ND	0.004
Mean	0.016	0.016	ID	ID	0.001	ID	ID	ID	0.001	ID	0.003	0.001	ID	ID	0.006	0.005	0.008	0.008
Standard Deviation	0.002	0.001	ID	ID	0.001	ID	ID	ID	0.001	ID	0.001	0.000	ID	ID	0.003	0.004	0.003	0.004
Median	0.016	0.016	ID	ID	0.001	ID	ID	ID	5E-04	ID	0.002	8E-04	ID	ID	0.005	0.0043	0.007	0.007
Barium, dissolved mg/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	33	4	11	8
No. of Detections	72	8	59	7	67	8	72	8	78	8	78	8	48	4	33	4	11	8
Maximum	0.018	0.006	0.02	0.007	0.2	0.002	0.009	0.005	0.083	0.007	0.04	0.04	0.008	0.003	0.04	0.0166	0.049	0.0406
Minimum	0.004	0.005	ND	0.006	ND	0.001	0.004	0.004	0.005	0.005	0.026	0.034	0.002	0.002	0.009	0.012	0.0071	0.0315
Mean	0.007	0.006	0.011	0.006	0.007	0.001	0.005	0.004	0.009	0.006	0.033	0.037	0.003	0.003	0.024	0.013	0.035	0.035
Standard Deviation	0.002	0.000	0.004	0.000	0.024	0.000	0.001	0.000	0.009	0.000	0.003	0.002	0.001	0.000	0.009	0.002	0.010	0.003
Median	0.007	0.006	0.010	0.006	0.002	0.001	0.005	0.004	0.007	0.006	0.034	0.036	0.002	0.003	0.024	0.012	0.036	0.0351
Benzene, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	0	0	0	0	0	0	3	0	2	0	0	0	3	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	0.6	ND	0.24	ND	ND	ND	1.23	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.2	ID	ID	ID	ID	ID	0.2	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.1	ID	ID	ID	ID	ID	0.3	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.1	ID	ID	ID	ID	ID	0.1	ID	ID	ID
Dichlorodifluoromethane, ug/L																		
No. of Analyses	63	8	52	7	62	8	63	8	63	8	62	8	41	4	29	5	10	8
No. of Detections	0	0	1	0	0	0	0	0	17	0	56	7	0	0	0	0	0	0
Maximum	ND	ND	0.84	ND	ND	ND	ND	ND	0.67	ND	46	8.24	ND	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.2	ID	11.6	4.7	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.2	ID	11.8	2.6	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.1	ID	8.05	5.055	ID	ID	ID	ID	ID	ID

Table 4-2b
Statistical Summary of Perched Zones
Groundwater Data

Well Location	MW-27A		MW-28		MW-29		MW-55		MW-30A		MW-47		MW-62		MW-EB6		MW-101	MW-101
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Zone	North and West Perched Zones								East Perched Zone								SSWA	
1,1-Dichloroethane, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	0	0	0	0	0	0	77	8	70	8	47	4	0	0	1	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	77	3.32	2.1	0.591	13	1.35	ND	ND	0.21	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.26	ND	0.46	ND	0.971	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	17.9	2.7	0.5	0.5	5.7	1.2	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	17.9	0.4	0.3	0.0	3.6	0.2	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	10	2.515	0.46	0.506	5.4	1.335	ID	ID	ID	ID
1,2-Dichloroethane, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	0	0	0	0	0	0	42	0	1	0	7	0	0	0	1	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	3.8	ND	0.21	ND	0.6	ND	ND	ND	0.22	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.6	ID	ID	ID	0.1	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.7	ID	ID	ID	0.1	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.305	ID	ID	ID	0.1	ID	ID	ID	ID	ID
cis 1,2-Dichloroethene, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	2	0	0	0	0	0	78	7	74	7	48	4	0	0	1	0
Maximum	ND	ND	0.24	ND	ND	ND	ND	ND	110	4.8	3.2	1.8	14	2.74	ND	ND	0.21	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	4.37	ND	ND	ND	1.3	1.29	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	27.3	3.5	1.0	1.2	7.0	2.3	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	26.1	1.5	0.7	0.5	3.4	0.7	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	17	3.97	0.715	1.28	7	2.565	ID	ID	ID	ID
1,2-Dichloropropane, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	0	0	0	0	0	0	45	0	0	0	6	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND	ND	ND	0.32	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.4	ID	ID	ID	0.1	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.4	ID	ID	ID	0.1	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.285	ID	ID	ID	0.1	ID	ID	ID	ID	ID
Tetrachloroethene, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Toluene, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	2	0	2	0	3	0	2	0	4	0	1	1	13	3	0	0
Maximum	ND	ND	0.41	ND	0.38	ND	0.59	ND	1.7	ND	0.78	ND	0.72	0.518	4.27	3.49	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	0.11	ID	ID	ID	0.13	ID	ID	ID	0.49	1.04	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	0.06	ID	ID	ID	0.12	ID	ID	ID	0.99	1.42	ID	ID
Median	ID	ID	ID	ID	ID	ID	0.10	ID	ID	ID	0.10	ID	ID	ID	0.10	0.51	ID	ID

Table 4-2b
Statistical Summary of Perched Zones Groundwater Data

Well Location	MW-27A		MW-28		MW-29		MW-55		MW-30A		MW-47		MW-62		MW-EB6		MW-101	MW-101
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
Zone	North and West Perched Zones								East Perched Zone								SSWA	
Trichloroethene, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	0	0	0	0	0	0	0	0	78	8	0	0	25	0	0	0	0	0
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	3.5	1.33	ND	ND	0.47	ND	ND	ND	ND	ND
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	0.939	0.86	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	1.78	1.06	ID	ID	0.19	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.51	0.18	ID	ID	0.10	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	1.6	1.014	ID	ID	0.20	ID	ID	ID	ID	ID
Vinyl Chloride, ug/L																		
No. of Analyses	72	8	60	7	71	8	72	8	78	8	78	8	48	4	36	5	10	8
No. of Detections	1	0	0	0	0	0	0	0	24	0	78	8	3	0	1	0	10	8
Maximum	0.06	ND	ND	ND	ND	ND	ND	ND	3.22	ND	15.9	8.55	0.23	ND	0.02	ND	0.9	0.769
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	4.47	ND	ND	ND	ND	0.51	0.219
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.24	ID	7.29	5.84	0.03	ID	ID	ID	1	0
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.59	ID	3.68	1.36	0.05	ID	ID	ID	0	0
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.01	ID	6.9	5.525	0.01	ID	ID	ID	0.66	0.4195

NOTES: ND = Not Detected ID = Insufficent Data to calculate statistic.
Perched Zone Wells MW-25, MW-41S, MW-41D, NW-45, MW-79, MW-102 and MW-103 are not tabulated due to insufficient data.

Table 4-3a
Summary of Regional Aquifer
Groundwater Data Trend Tests

Well Location	MW-24		MW-56		MW-57		MW-58A		MW-59		MW-60		MW-65		MW-76		MW-82		MW-83		MW-94	
											Upgradient South											
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field)	D	--	D	--	--	--	--	--	D	--	D	--	--	--	D	--	--	I	D	--	--	--
Specific Conductance	I	--	D	--	D	--	I	--	D	--	--	--	--	--	--	--	--	--	I	--	D	--
Total Dissolved Solids	I	--	--	--	--	--	I	--	D	--	--	--	--	--	--	--	--	--	I	--	--	--
Alkalinity, total (CaCO3)	I	I	D	--	D	--	I	--	D	--	--	--	--	--	--	--	--	--	I	--	--	--
Ammonia as N	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	--	--	I	--	D	I	D	--	I	--	D	--	--	--	--	I	--	--	I	--	I	--
Nitrate as N	--	--	--	--	--	--	--	--	--	--	D	--	--	--	--	--	--	--	D	--	--	--
Sulfate	I	--	D	I	D	--	I	--	D	I	--	--	D	I	I	--	I	--	I	--	D	--
Iron dissolved	--	I	--	--	--	--	I	--	D	--	--	--	I	--	--	--	--	--	--	--	D	--
Manganese dissolved	D	I	--	--	D	--	I	--	D	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium dissolved	I	--	D	--	D	--	I	--	D	--	--	--	--	--	--	--	I	--	I	--	--	--
Magnesium dissolved	I	--	D	--	D	--	I	--	D	--	--	--	--	--	I	--	I	--	I	--	--	--
Potassium dissolved	I	--	D	--	--	--	I	--	--	--	--	--	--	--	--	--	I	--	--	--	I	--
Sodium dissolved	I	--	D	--	--	--	I	--	D	--	--	--	--	--	--	--	I	--	--	--	--	--
Arsenic dissolved	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium dissolved	--	--	D	D	D	--	--	--	D	--	D	--	D	I	--	--	--	--	D	--	D	--
Dichlorodifluoromethane	D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis 12-Dichloroethene	--	--	--	--	--	--	--	--	I	--	--	--	--	--	D	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	--	--	--	--	--	--
Trichloroethene	I	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	D	--	D	--	D	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	--	--	--	--	--	--	--

D	Decreasing Trend
I	Increasing Trend
--	No Trend

Table 4-3a
Summary of Regional Aquifer
Groundwater Data Trend Tests

Well Location	MW-21		MW-73		MW-84		MW-81		MW-99		MW-93		MW-95	
		Upgradient Northwest						Upgradient Northeast				Cross Gradient		
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field)	I	--	--	--	D	--	--	--	--	--	I	I	--	--
Specific Conductance	I	--	D	--	--	--	I	--	D	--	I	--	D	--
Total Dissolved Solids	--	--	--	--	--	--	--	--	D	--	I	--	--	--
Alkalinity, total (CaCO3)	I	--	D	--	D	--	I	--	D	--	--	I	D	--
Ammonia as N	--	--	--	--	--	--	--	--	--	--	--	--	I	--
Chloride	I	--	I	--	I	I	I	--	I	--	--	--	I	--
Nitrate as N	--	--	I	D	I	--	--	--	D	--	D	I	--	--
Sulfate	D	--	D	--	--	--	I	--	--	--	I	--	D	--
Iron dissolved	I	D	--	--	--	--	--	--	--	--	D	--	D	--
Manganese dissolved	I	--	--	--	D	--	D	--	D	--	I	D	D	--
Calcium dissolved	I	--	D	--	--	--	I	--	--	--	I	--	D	D
Magnesium dissolved	I	D	D	--	--	--	I	--	--	--	I	--	D	--
Potassium dissolved	I	--	D	--	D	--	--	--	D	--	I	--	--	D
Sodium dissolved	I	--	D	--	--	--	D	--	D	--	I	--	D	--
Arsenic dissolved	D	--	--	--	--	--	D	--	D	D	D	--	--	--
Barium dissolved	D	--	D	--	--	--	D	--	D	--	--	--	D	--
Dichlorodifluoromethane	D	--	--	--	--	--	--	--	--	--	--	--	--	--
cis 12-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--

D	Decreasing Trend
I	Increasing Trend
--	No Trend

Table 4-3a
Summary of Regional Aquifer
Groundwater Data Trend Tests

Well Location	MW-70		MW-77		MW-78		MW-100		MW-64		MW-66		MW-67		MW-68		MW-69		MW-72	
	Interior								Vertical to Key Facilities								Westside Downgradient			
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field)	--	--	D	--	D	--	D	--	--	--	D	--	D	--	--	--	--	--	--	--
Specific Conductance	--	--	--	D	--	--	D	--	I	--	I	--	I	--	I	--	I	--	D	--
Total Dissolved Solids	I	--	--	--	--	--	D	--	I	--	--	--	I	I	I	--	I	--	D	--
Alkalinity, total (CaCO3)	--	--	--	D	--	--	D	I	--	--	I	--	I	I	I	--	I	--	--	--
Ammonia as N	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	I	--	--	--
Chloride	I	--	--	--	--	--	--	--	I	--	--	D	--	--	--	--	I	I	I	--
Nitrate as N	D	--	I	--	--	--	--	--	I	--	I	I	D	D	--	--	--	--	--	--
Sulfate	I	--	--	--	D	--	--	--	I	--	I	--	I	--	--	--	--	--	D	I
Iron dissolved	--	--	D	--	--	--	D	--	I	--	--	--	I	--	I	D	I	--	D	--
Manganese dissolved	I	D	D	--	--	--	I	--	D	I	--	--	I	--	I	--	I	--	D	--
Calcium dissolved	I	--	--	D	--	--	D	--	I	--	I	--	I	--	I	--	I	--	D	--
Magnesium dissolved	I	I	--	D	--	--	--	--	I	--	I	--	I	--	I	--	I	--	D	--
Potassium dissolved	I	--	--	D	I	--	I	D	--	--	I	--	I	--	I	--	I	--	D	D
Sodium dissolved	--	I	--	D	I	--	I	--	--	--	I	--	I	--	I	--	I	--	D	--
Arsenic dissolved	--	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	--	--	--	--
Barium dissolved	D	--	--	D	--	--	D	--	--	--	--	--	I	I	I	--	I	--	D	--
Dichlorodifluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis 12-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	I	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

D	Decreasing Trend
I	Increasing Trend
--	No Trend

Table 4-3a
Summary of Regional Aquifer
Groundwater Data Trend Tests

Well Location	MW-74		MW-75		MW-80		MW-85		MW-87		MW-91		MW-86		MW-88		MW-89		MW-90		MW-43	
	Downgradient												Downgradient of Northhend Facilities									
Time Period	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field)	D	--	D	--	--	--	D	--	D	--	--	--	--	--	D	--	--	--	--	--	--	--
Specific Conductance	I	--	--	--	--	--	I	--	I	--	D	--	--	--	I	--	I	--	--	--	--	--
Total Dissolved Solids	I	I	--	--	I	--	I	--	I	I	--	--	--	--	--	--	--	--	I	--	--	I
Alkalinity, total (CaCO3)	I	--	I	--	I	--	I	--	--	--	D	--	--	--	--	--	I	--	--	--	--	--
Ammonia as N	--	--	--	--	--	--	--	--	I	--	I	--	--	--	--	--	--	--	I	--	I	--
Chloride	I	--	I	--	--	--	I	I	I	I	D	--	D	--	I	--	I	--	I	--	I	I
Nitrate as N	D	I	--	--	--	--	--	--	--	--	I	--	I	--	I	--	--	--	--	--	--	--
Sulfate	I	--	I	--	I	--	--	--	I	I	--	I	D	--	--	--	--	--	I	--	I	--
Iron dissolved	I	D	--	--	I	--	--	--	I	I	D	--	I	--	D	--	--	--	I	--	--	--
Manganese dissolved	I	D	--	--	I	--	--	--	--	--	D	I	D	--	D	--	D	--	--	--	--	--
Calcium dissolved	I	--	I	--	I	--	I	--	I	--	D	--	--	--	--	--	I	--	I	--	--	D
Magnesium dissolved	I	--	I	--	--	--	I	--	I	--	--	--	--	--	--	--	I	--	I	--	--	--
Potassium dissolved	I	--	--	--	--	--	I	--	I	--	--	--	--	--	D	--	--	--	I	--	--	--
Sodium dissolved	I	--	--	--	--	--	I	--	I	--	--	--	--	--	--	--	I	I	I	--	--	--
Arsenic dissolved	--	--	D	--	--	--	--	--	--	--	D	--	--	--	I	D	D	--	--	--	--	--
Barium dissolved	I	--	D	--	I	--	--	--	--	--	D	--	D	--	D	--	D	--	--	--	--	D
Dichlorodifluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--
cis 12-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

D	Decreasing Trend
I	Increasing Trend
--	No Trend

Table 4-3b
Summary of Perched Zones
Groundwater Data Trend Tests

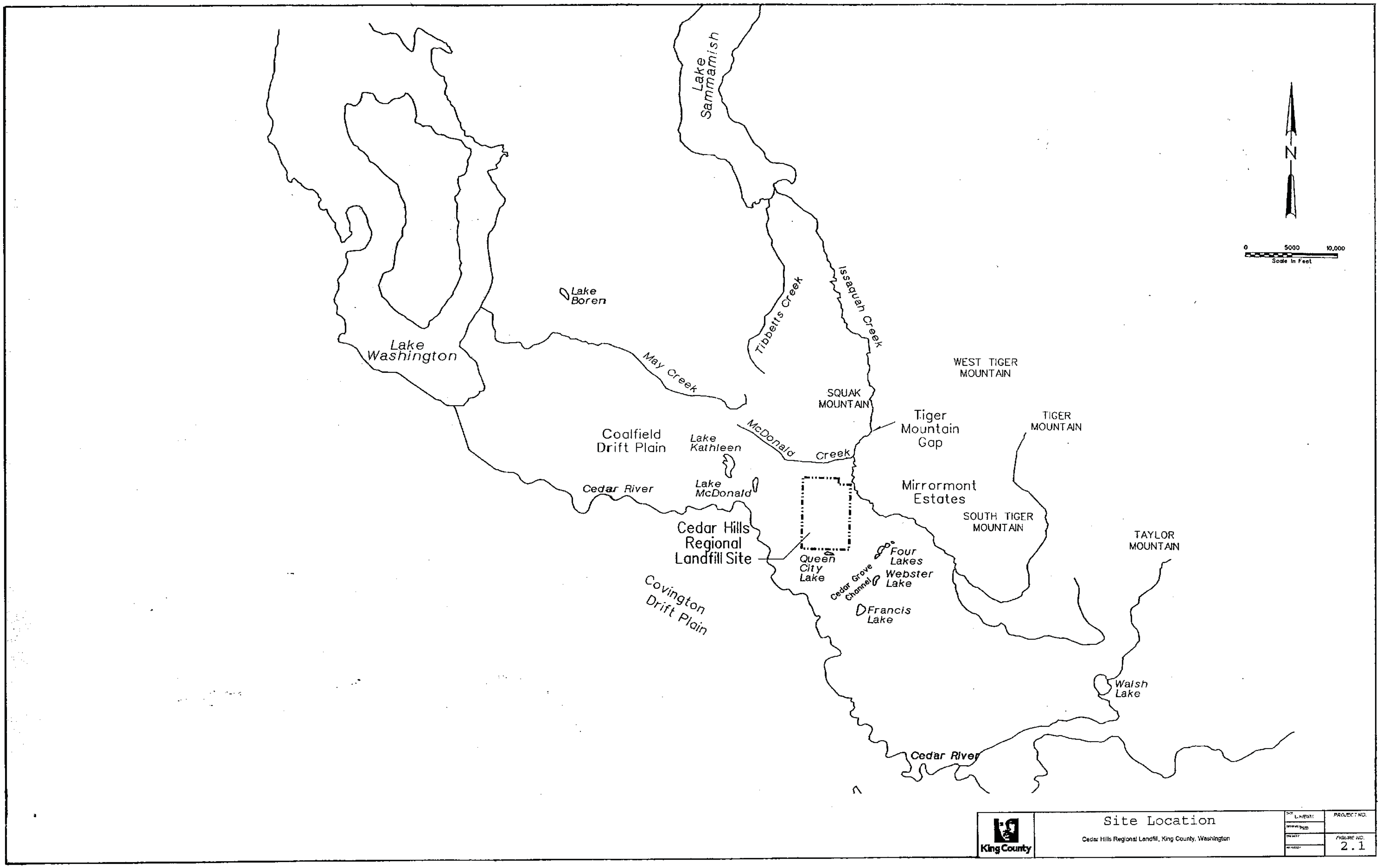
Well Location	MW-27A		MW-28		MW-29		MW-55		MW-30A		MW-47		MW-62		MW-EB6		MW-101	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, (Field)	--	--	D	--	D	--	--	--	D	--	--	--	D	--	--	--	--	D
Specific Conductance, (Field)	I	--	D	--	I	--	I	--	I	--	I	D	D	--	D	--	D	D
Total Dissolved Solids	--	--	D	--	--	--	I	--	I	--	I	D	D	--	--	--	--	--
Alkalinity total (CaCO3)	--	--	D	--	--	--	I	--	I	--	I	D	--	--	--	--	--	D
Ammonia as N	D	--	--	--	--	--	--	--	--	--	I	--	D	--	I	I	--	--
Chloride	--	D	I	--	I	D	--	--	I	--	D	--	D	--	--	--	--	--
Nitrate as N	--	--	--	--	--	--	--	--	D	--	--	--	D	--	--	--	D	--
Iron dissolved	--	--	D	--	--	--	I	--	--	--	D	--	--	--	D	--	--	--
Manganese dissolved	D	--	D	--	--	--	I	--	--	--	I	--	--	--	D	--	--	D
Calcium dissolved	--	--	D	--	--	--	I	--	I	--	I	--	D	--	D	--	--	D
Magnesium dissolved	--	--	D	--	I	--	I	--	I	--	I	--	D	--	D	--	--	--
Potassium dissolved	--	--	D	--	--	--	--	--	I	D	--	--	--	--	D	D	--	D
Sodium dissolved	--	--	D	--	--	--	--	--	I	--	I	--	D	D	--	--	D	--
Arsenic dissolved	D	--	--	--	--	--	--	--	--	--	D	--	--	--	D	--	--	D
Barium dissolved	D	--	D	--	--	--	D	--	--	--	--	--	D	--	D	--	D	D
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	--	--	--	--	--	--	--	--	D	--	D	--	--	--	--	--	--	--
11-DCA	--	--	--	--	--	--	--	--	D	--	--	--	D	--	--	--	--	--
12-DCA	--	--	--	--	--	--	--	--	D	--	--	--	D	--	--	--	--	--
cis 12-Dichloroethene	--	--	--	--	--	--	--	--	D	--	I	--	D	--	--	--	--	--
12-Dichloropropane	--	--	--	--	--	--	--	--	D	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	D	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	D	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	D	--	D	--	D	--	D	--	--	D

D	Decreasing Trend
I	Increasing Trend
--	No Trend

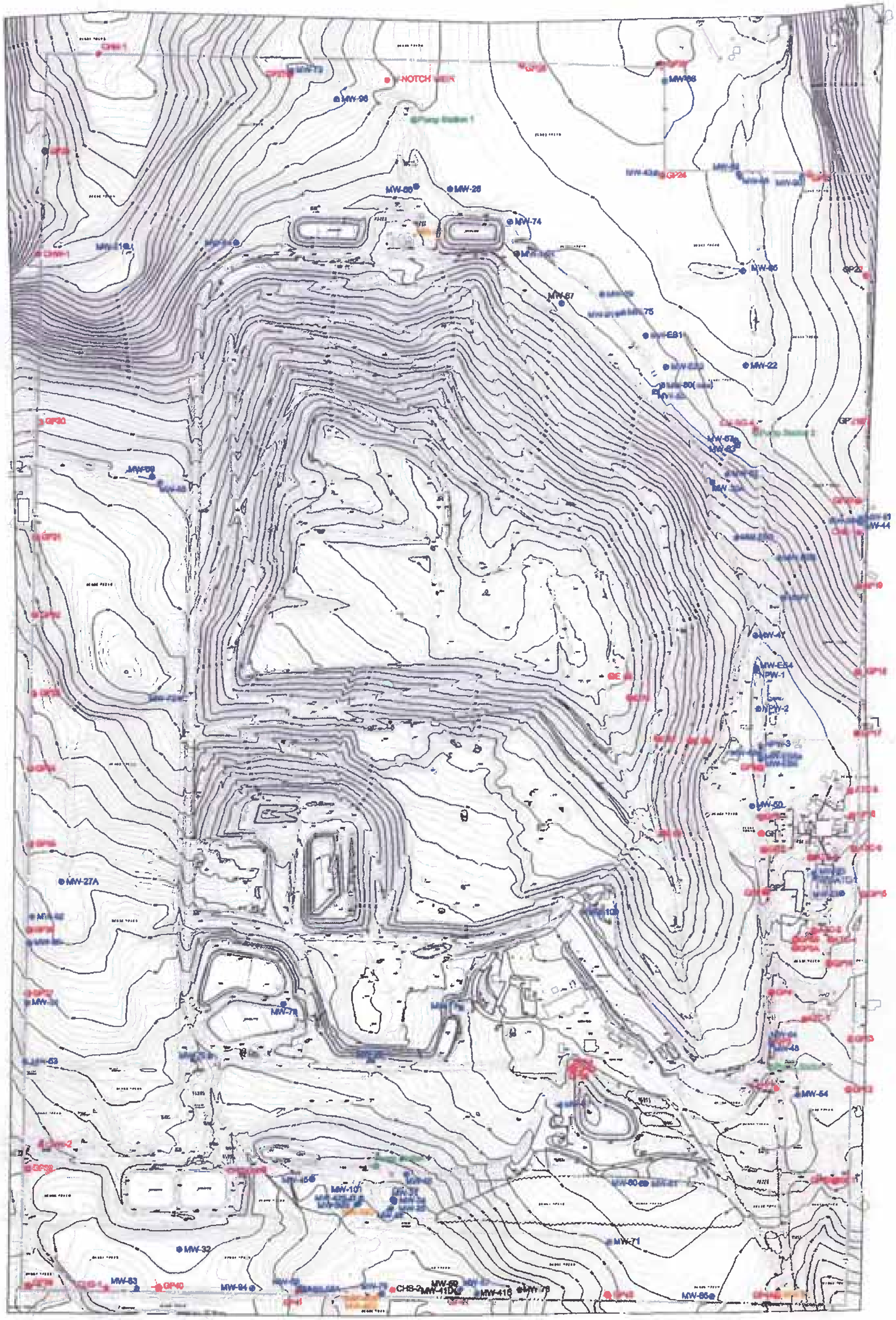
TABLE 4-4
CEDAR HILLS 2012 REGIONAL LANDFILL REGIONAL AQUIFER
SUMMARY OF WAC 173-351 APPENDIX I INTRAWELL PREDICTION LIMIT EXCEEDANCES

Parameter	Units	Well ID	Sample Date	Sample Value	Intrawell Limit Value
South Upgradient Wells					
Barium		MW-83	10/18/12	0.0066	0.0060
cis 1,2-Dichloroethene	ug/L	MW-59	10/08/12	0.6790	0.6660
Downgradient Wells					
Nitrate	mg/L	MW-66	10/12/12	0.757	0.67

FIGURES



Excerpted from Cedar Hills Regional Landfill Site-Wide Hydrogeologic Report 2004



LEGEND

MW–9 Monitoring Well

MW–9 Surface Water Stations

GP–19 Gas Probe

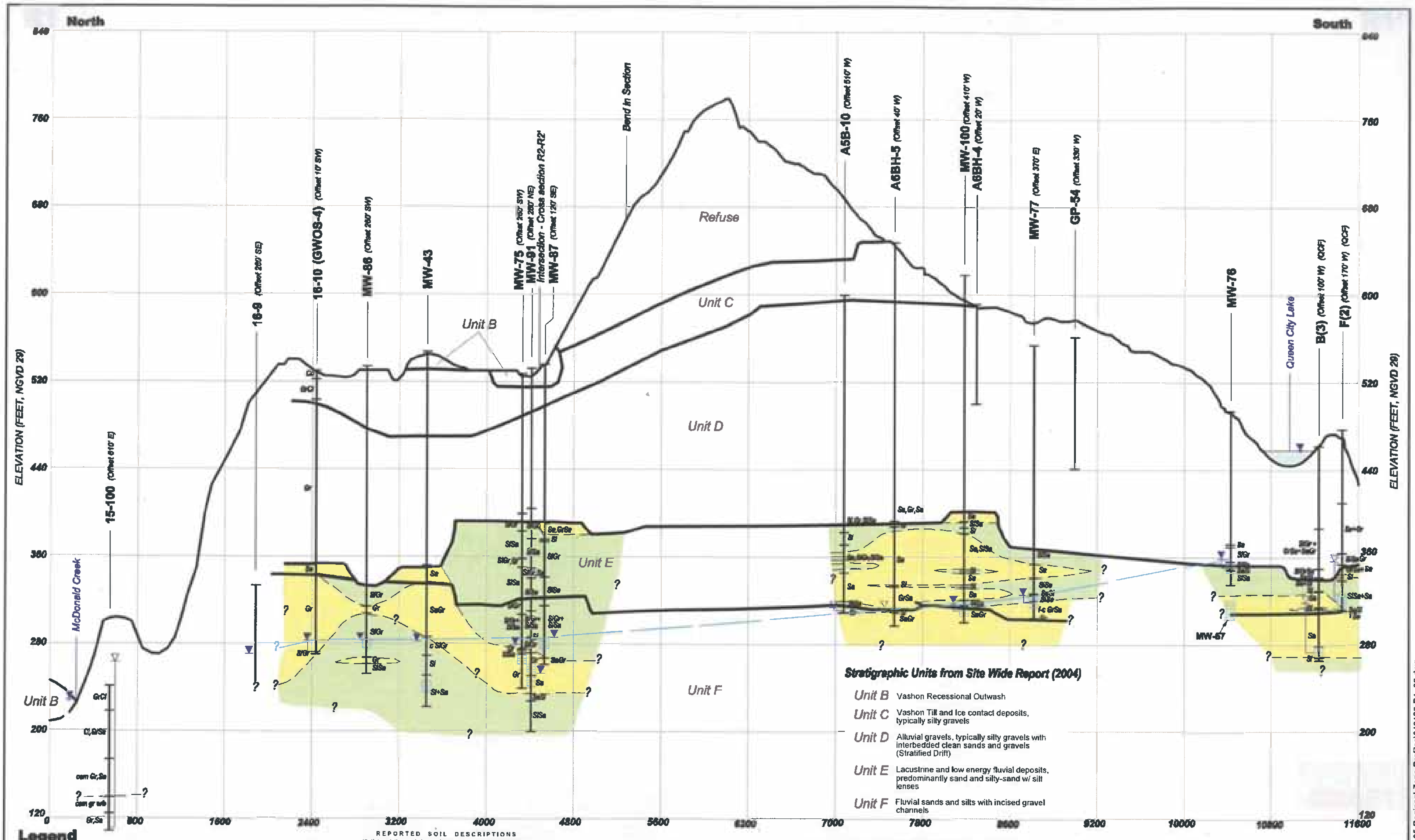
MW–8 Decommissioned Monitoring Well

GP–13 Decommissioned Gas Probe

Pump Station NO.__

Scale 1"-200'

King County Solid Waste Division	DATE: Oct. 2007	Figure 2.2 **SITE MAP** Cedar Hills Landfill Maple Valley, Washington	Aero-Metric Aerial Photo taked August 24, 2007	PROJECT NO.



Regional Cross Section North – South

Cedar Hills Regional Landfill, King County, Washington

King County

DATE	May 2009
DESIGNED BY	LJH/EWM
DRAWN BY	PMB
REVISED BY	EWM (March 2010)
PROJECT NO.	040122
FIGURE NO.	2.3

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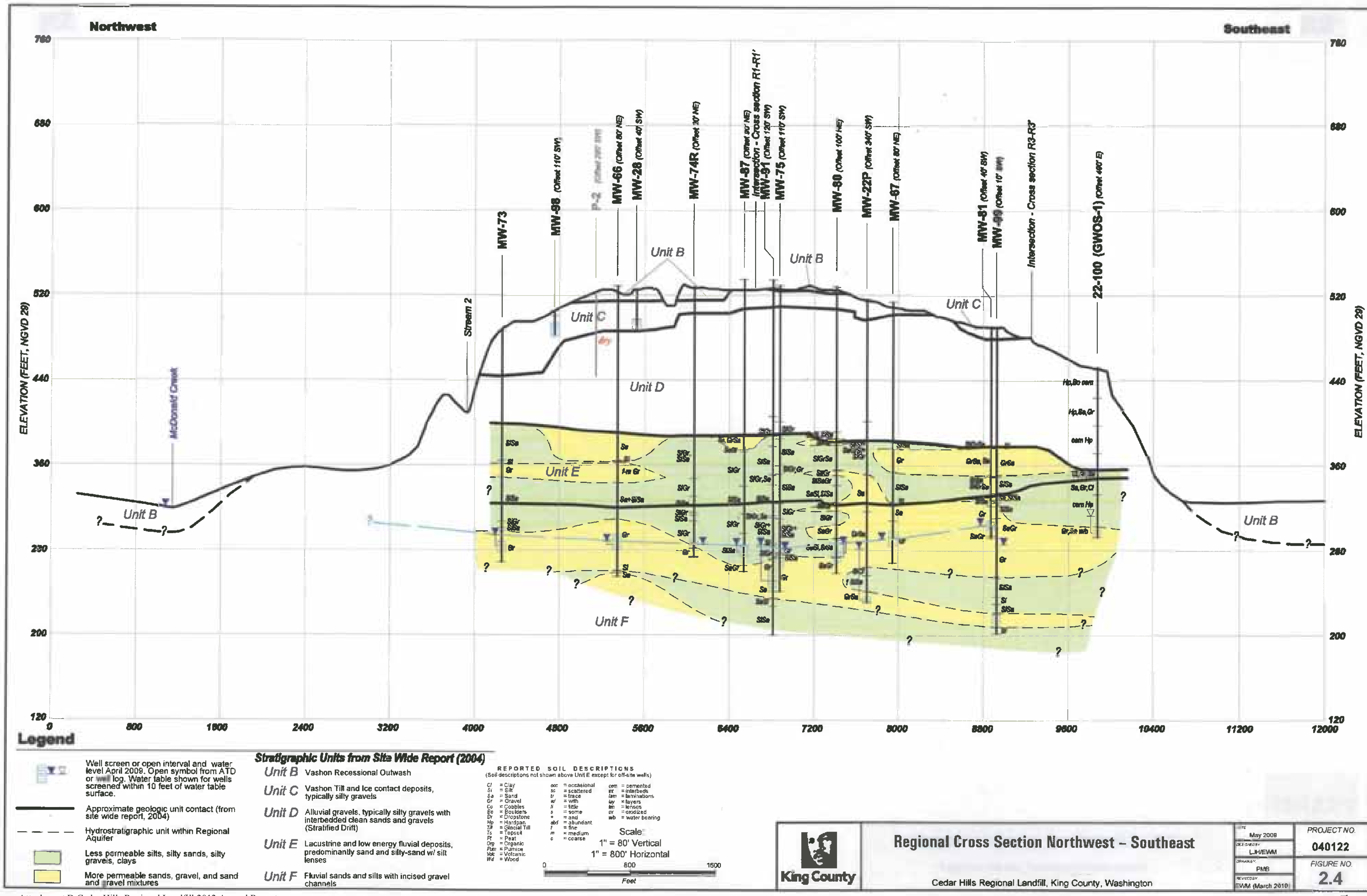
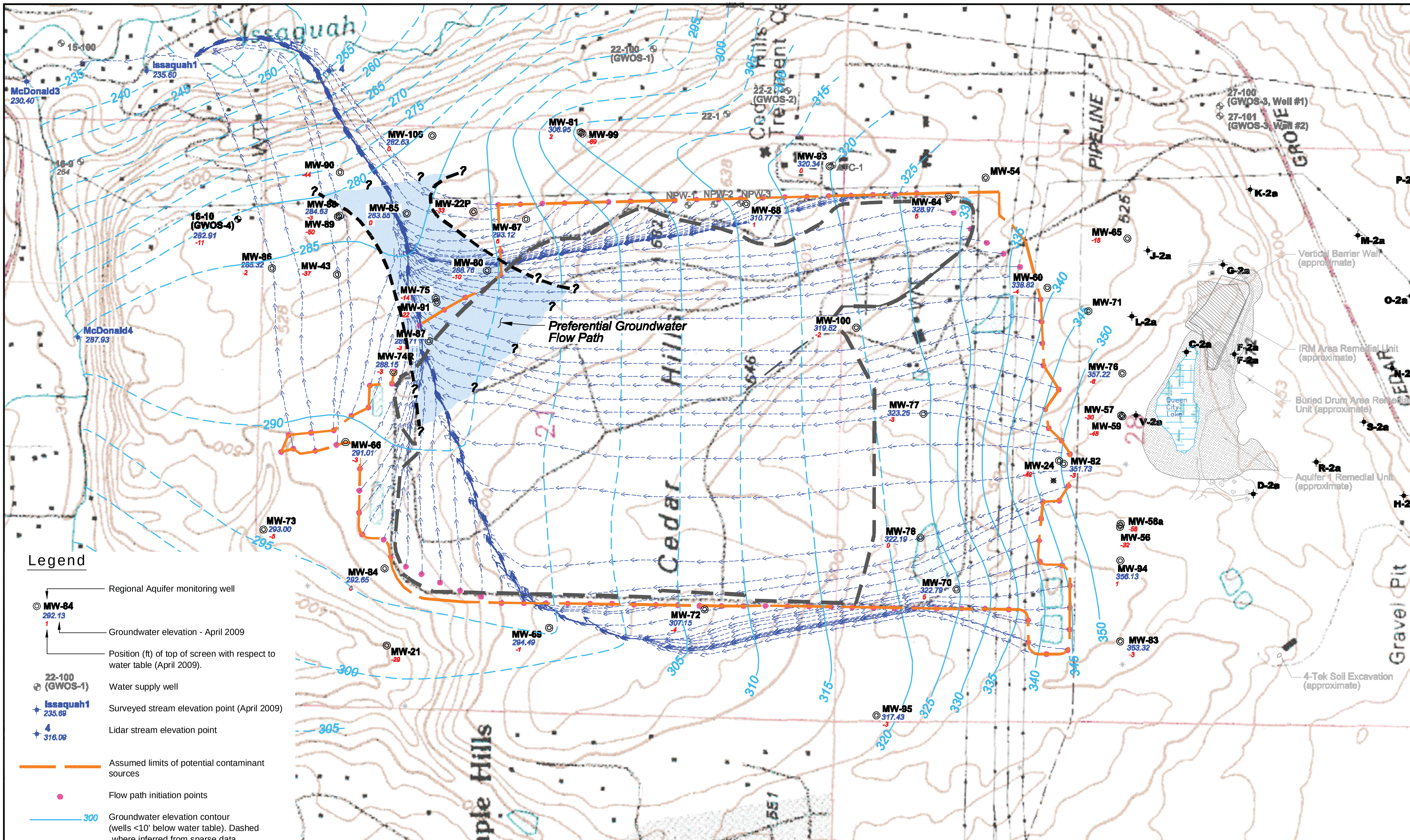


Attachment D Cedar Hills Regional Landfill 2012 Annual Report

Excerpted From: *Cedar Hills Regional Aquifer Regional Aquifer Technical Memorandum 2011*



Cedar Hills Regional Landfill

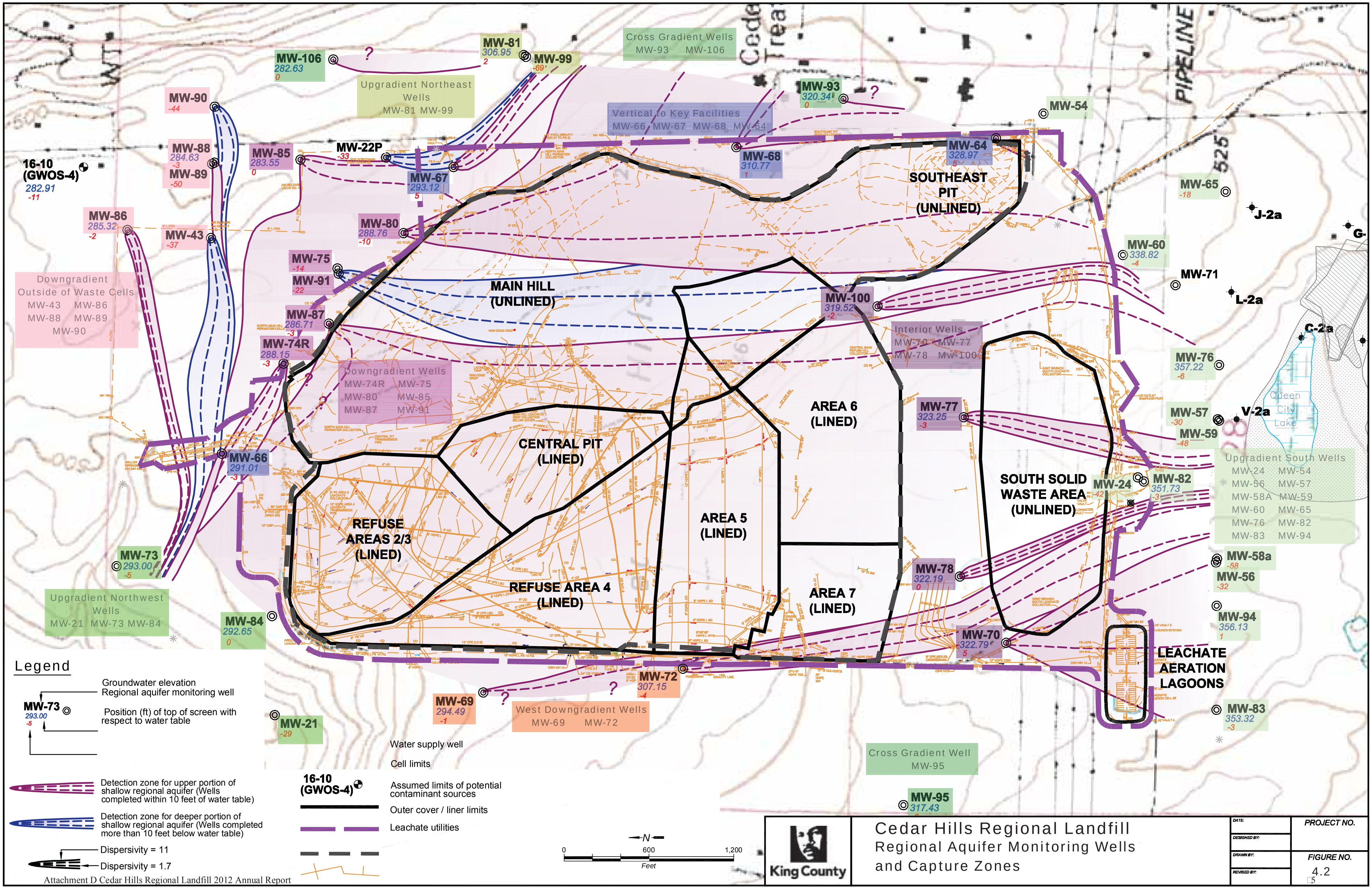
Regional Aquifer Flow Paths

King County

PROJECT NO.

FIGURE NO.

4.1



King County

Cedar Hills Regional Landfill
Regional Aquifer Monitoring Wells and Capture Zones

DATE:
DESIGNED BY:
DRAWN BY:
REVISED BY:

PROJECT NO.

FIGURE NO.
4.2